INDEXED.

International Marine Engineering

OCTOBER, 1910.

NEW AMERICAN-HAWIIAN STEAMERS.

The three steamers, *Kentuckian, Georgian* and *Honolulan,* recently constructed by the Maryland Steel Company, Sparrow's Point, Md., for the American-Hawaiian Steamship Company, of New York, are of the best type of American merchant cargo vesels. The vessels and fittings are built to the highest requirements and classed X-100 A-1 Lloyds. They are two-masted, forward and aft, schooner-rigged, with accommodations for crew and twenty-four passengers on the *Kentuckian* and *Georgian* and forty-eight passengers on the *Honolulan.*

DECK SCENE ON ONE OF THE NEW AMERICAN-HAWAIIAN STEAMERS, SHOWING AMPLE FACILITIES FOR HANDLING CARGO.

The general dimensions are as follows:

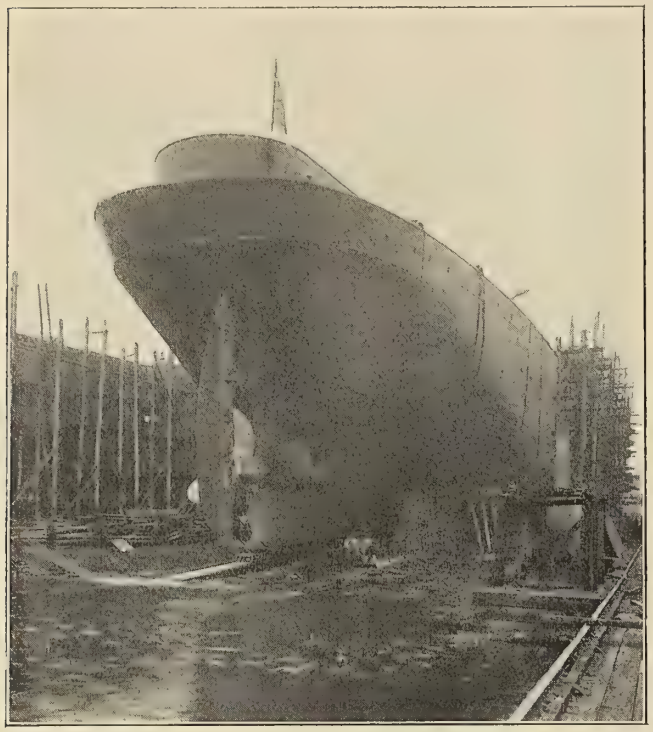
Length over all	429 feet 2 inches.
Length between perpendiculars	414 feet 2 inches.
Breadth, molded	53 feet 6 inches.
Depth, molded, to shelter deck	39 feet.

All have straight stems, elliptical sterns with three steel decks extending all fore and aft, fore and aft peaks, and forward and after deep tanks. Double-bottom tanks, 1, 2, 5 and 6, are constructed for carrying either fuel oil or water ballast. Double-bottom tanks, 3 and 4, under the engine room and fire room are fitted to carry fresh water. There are seven watertight bulkheads, all extending to the upper deck and the after peak extending to the shelter deck.

In the afterhold a complete oil-tight deck is laid at the top of the shaft tunnel, forming an after deep tank alongside the tunnel. The deep tank forward of the fire rom is fitted up for either cargo, oil or water ballast.

A cofferdam, one frame space in length, is fitted between this deep tank and the fire room. There are five hatches through each deck, and hatches to the deep tanks extending to the upper deck.

The accommodations for the crew, officers and passengers are in steel deck houses above the shelter deck and in the after upper 'tween decks. The refrigerator room is located on the upper deck immediately aft of the engine room.



STERN VIEW OF THE GEORGIAN BEFORE LAUNCHING.

The rooms for passengers are fitted with two pipe frame berths and pipe frame seats with spring mattresses, the seats being used for a berth. A folding lavatory is fitted in each room. The toilet arrangements are ample and of the very best quality.

The dining saloon for officers and passengers is located in the forward end of the shelter deck-house, and is finished with quartered oak, with the ceiling paneled and finished in white enamel.

The floors of the officers' and crew's quarters and passengers' rooms are covered with Asbestolith. The toilet rooms are tiled and fitted with enameled iron fittings.

Each vessel is fitted with a steam windlass, steam winches, steam capstan and Brown Bros'. steam tiller and auxiliary tiller, with engine actuated by a telemotor from the steering house, pilot house and flying bridge. These were all furnished by Hyde Windlass Company, Bath, Me.

The two steel masts and four derrick masts are fitted with booms for handling the cargo. There are in all twenty-one booms, all of 5 tons capacity, with the exception of one on after side of the foremast, which is of 30 tons capacity. There are three cargo ports on each side of the upper and shelter decks, also a small port in the coal bunker for carrying case goods in the bunkers while ship is burning oil.

These vessels carry 8,600 tons deadweight on 27 feet mean draft, and maintain a sea speed of 11 knots loaded. They are all fitted with wireless, and all holds are ceiled and have sparring fitted. Special freight rooms are fitted in the lower 'tween decks for bonded freight.

The *Honolulan* has a social hall and smoking room for the passengers. The social hall is finished in old ivory and the smoking room and dining room in selected quartered oak. The main entrance hall will have rubber tiling on the floor, and the other public rooms will have Asbestolith. The toilets are fitted with solid porcelain fixtures, all pipes nickel plated. The sides and floors of the toilets are tiled. The passengers' rooms are fitted with General Electric portable electric heaters.

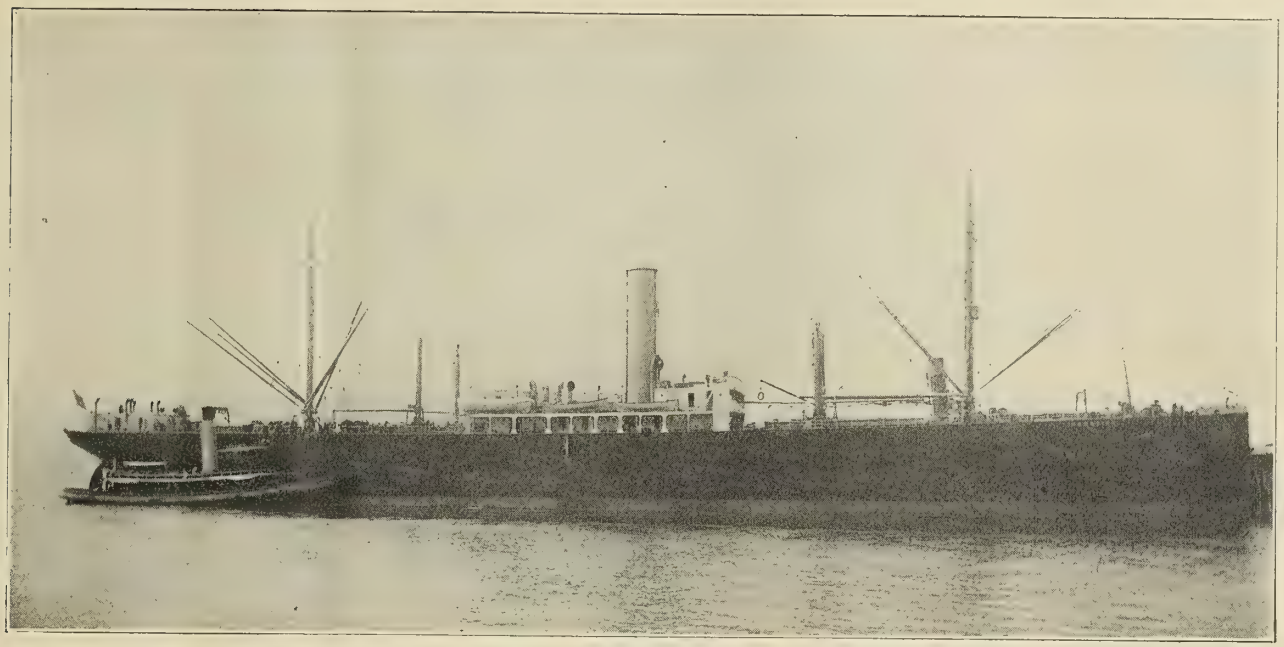
The *Kentuckian* and *Georgian* will run between Porto Mexico and New York, and the *Honolulan* between San Francisco and Honolulu. The *Honolulan* is fitted with Welin quadrant davits.

All three ships are of the single-screw type, and are driven by quadruple-expansion engines of the vertical inverted, direct-acting, surface-condensing type. All the machinery was built and classed 100 A-1 Lloyds.

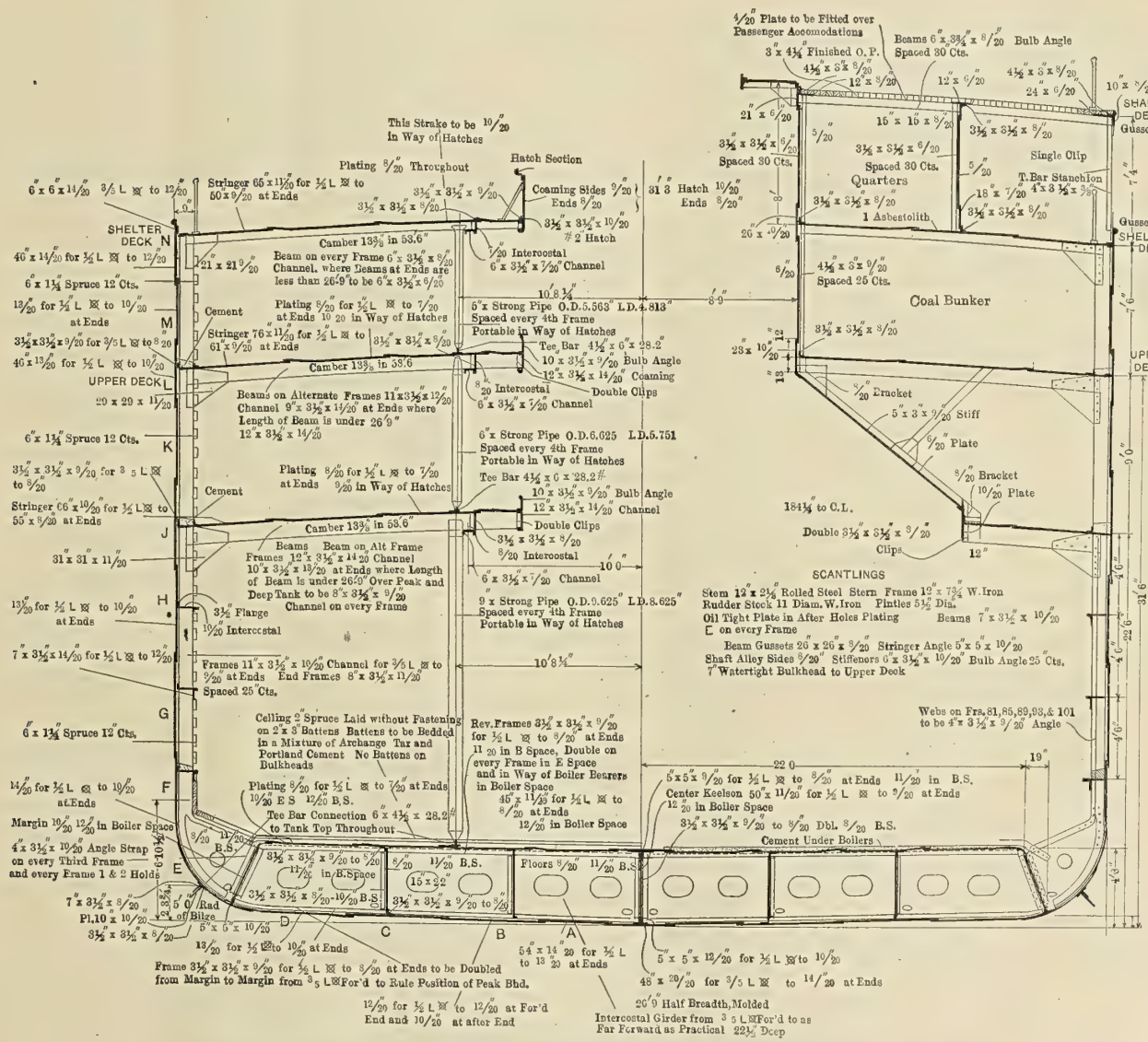
The cylinders are, respectively, 25 inches, 36 inches, 52 inches and 76 inches diameter by 54 inches stroke. The high and first intermediate are each fitted with one piston valve, and the second intermediate and low-pressure are each fitted with two piston valves. The valve gear is of the Stephenson double-bar link type, and is provided with a direct-acting reversing engine. The pistons, cylinder covers and valve chest covers are of cast iron. The engine is fitted with an operating gear, reversing engine and throttle, which is all controlled from the working platform.

The bedplate and columns are cast iron of the box type. The crankshaft is built up in four interchangeable sections, with solid couplings forged on the shaft. The turning gear is located on the coupling at the aften end of the engine. The thrust block is fitted with cast steel horseshoe thrust collars.

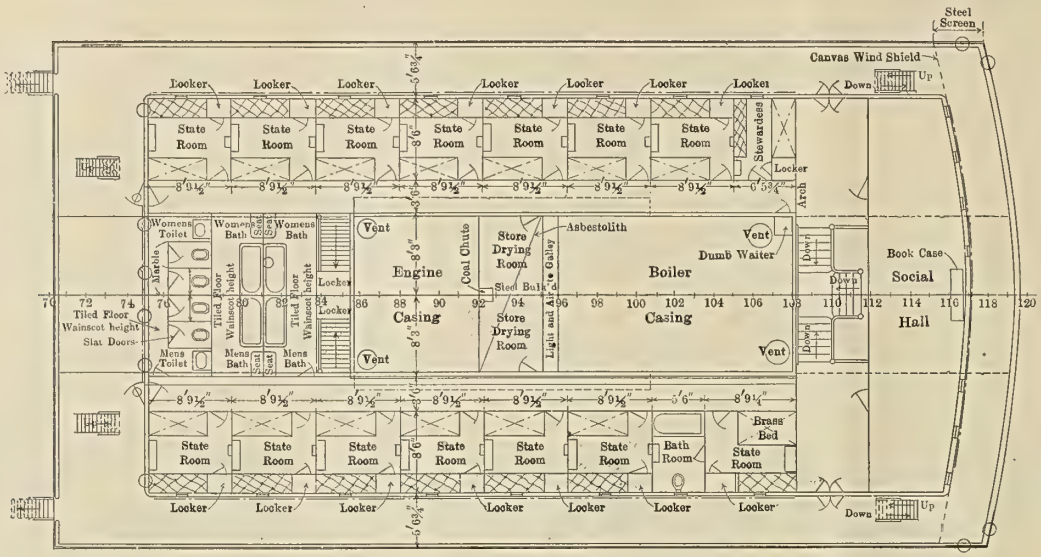
HULL OF ONE OF THE NEW AMERICAN-HAWAIIAN STEAMERS IN FRAME AND NEARLY PLATED.



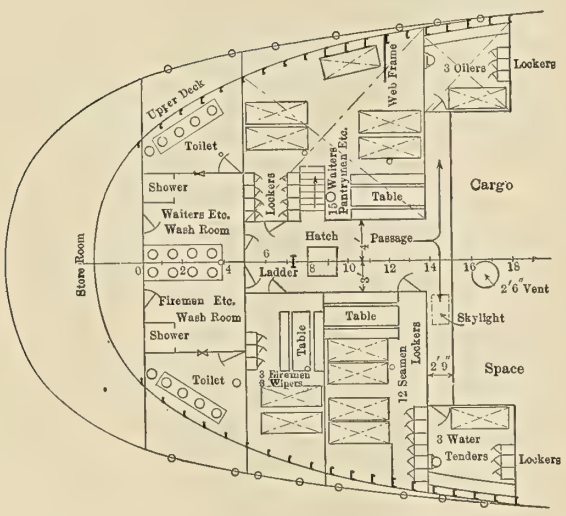
THE GEORGIAN.



MIDSHIP SECTION OF THE NEW AMERICAN-HAWAIIAN STEAMERS, SHOWING PRINCIPAL SCANTLINGS.



SHADE DECK PLAN OF THE HONOLULAN.



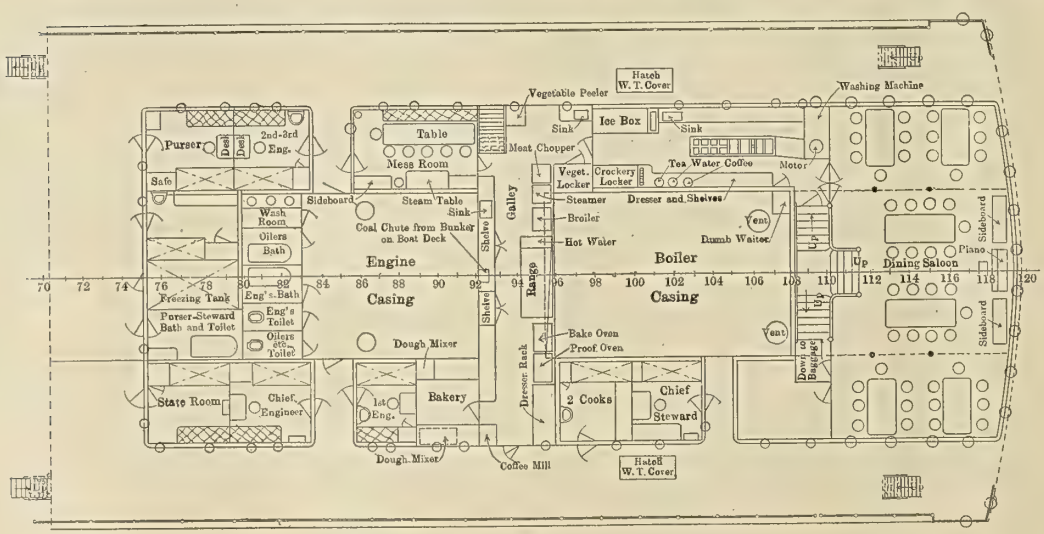
POOP DECK OF THE HONOLULAN.

The tail shaft has a continuous gunmetal bearing, shrunk on. The propeller has a cast steel hub, with four adjustable bronze blades.

The main condenser is of the independent, horizontal, cylindrical type, with 7,000 square feet cooling surface. The air pump is of the single-acting type, and is driven off the main engine by means of levers and links, connected to the low-pressure crosshead. There are also two plunger bilge pumps driven off the air pump crosshead. The circulating pump is of the centrifugal type, driven by a simple 10-inch by 9-inch vertical engine. There is provided a feed-water filter tank, and also a vertical multi-coil feed heater. There is also provided an auxiliary condenser, having 1,000 square feet of cooling surface, and fitted with a combined air and circulating pump.

The other independent pumps located in the engine room are as follows: One main, one auxiliary and one donkey feed pump; one injector; one ballast; one oil trimming (for fuel oil tanks); one fire and bilge; one sanitary and one fresh-water pump.

There are three single-end Scotch boilers, each 15 feet 9 inches diameter, by 12 feet 3 inches long, between heads, built for a working pressure of 215 pounds per square inch. Each

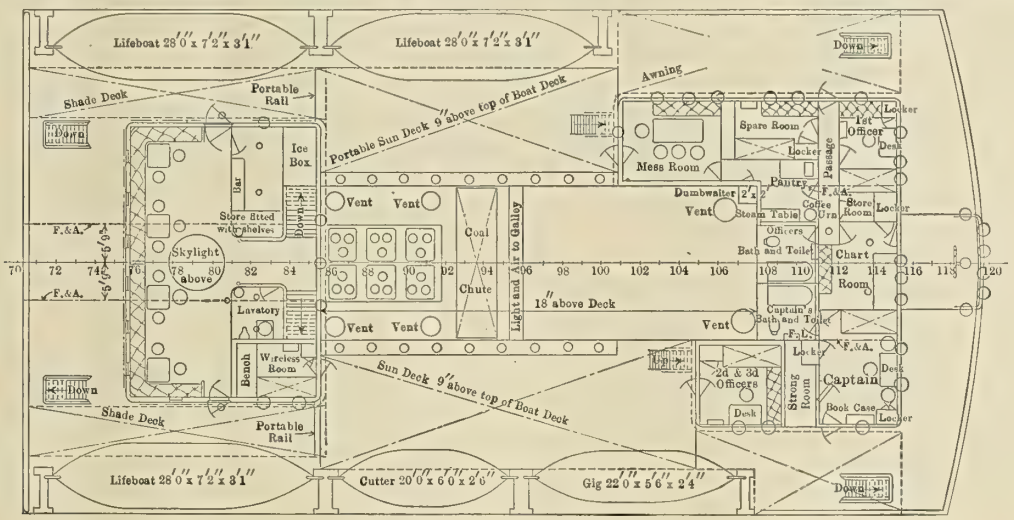


SHELTER DECK PLAN OF THE HONOLULAN.

boiler has four 40-inch furnaces of the Morison suspension type, with separate combustion chambers. These boilers are fitted with hot air forced draft system, for which there is provided one steel plate blower, driven by two simple vertical engines.

The furnaces are equipped for burning fuel oil, and for this purpose there is provided the following: Two main fuel oil pumps; one auxiliary oil pump; two vertical fuel oil heaters and one pressure blower, for atomizing the oil at the burners. The ships also carry the necessary fittings, to enable the boilers to be converted easily into coal burners. For this there is also provided a steam ash hoist ram. For harbor use there is a donkey boiler of the Scotch type, which is 10 feet diameter by 9 feet 6 inches between heads, and built for a working pressure of 215 pounds per square inch.

The other auxiliaries provided are as follows: A distilling system, consisting of two 20-ton evaporators, two 20-inch multi-coil distillers and one aerating tank; one 2-ton refrigerating plant; two 20-kilowatt dynamos; a Clayton fire extinguishing and fumigating system, and a system of hold ventilation, by means of a suction fan.



BOAT DECK PLAN OF THE HONOLULAN.

LIFE SAVING AT SEA.

BY SYDNEY F. WALKER.

The boat question which was considered last month is really only a part of the much larger question of saving life at sea and again there are two distinct problems to be met, that of saving the life of anyone falling overboard, with the ship underway, and that of saving all of the passengers and crew in case of wreck. The two questions merge into each other to a certain extent, inasmuch as the successful solution of both problems depends very largely upon the ability to lower a boat clear of the ship, and to disengage her from the boat falls in such a manner that she floats easily and quickly away from the ship.

As marine engineers know, even the steadiest ships roll in a seaway, and it is more often than otherwise that there is a call for life-saving appliances in a seaway than in a calm. When the ship is rolling heavily it is a very difficult problem to lower a boat into the water, and to disengage her on arrival in the water, without her being thrown up against the side of the ship and smashed to pieces. Tales of wrecks abound in instances where boats that have been lowered have been dashed to pieces, sometimes with crew and passengers in them, sometimes before there had been time to load them. Even with the very greatest care and skill in lowering boats from the ordinary davits, and with the best of disengaging apparatus, the chances of the boat being dashed up against the side, particularly if a ship has a high free board, are very great. In the old wooden frigates the quarter boats that were always ready for lowering were suspended from stout wooden davits, projecting well out from the side of the ship on each quarter, and there was therefore a fair amount of room between the end of the davit and the ship's side, so that if care was taken to lower quickly, when the ship rolled toward the boat, and to disengage immediately she was water borne, the boat got away safely. In smooth weather it was a very simple matter. The writer has seen cases, however, where even with great care boats have been smashed, and the davits, too, by the heavy seas that were pounding against the ship's quarter. With the ordinary iron davit carried by the bulk of the mercantile marine the question of lowering a boat at sea is a very difficult one indeed, if she is rolling at all, because there is so little clearance between the outer ends of the davits and the ship's side. The first part of the problem therefore is the provision of some kind of davit that will give the boat a chance of swinging clear of the ship's side.

DAVITS.

Several attempts have been made to accomplish this, such as the Bevis davit shown in Fig. 1, and that designed by the Messageries Maritimes shown in Fig. 2; the principle of which is the throwing of the end of the davit outboard, under control, so that the boat when lowered is at some distance from the ship's side. The latest, and apparently the best arrangement of the kind, is that invented by Mr. Axel Welin, shown in Figs. 3 to 5, in which the principle for the Bevis davit is extended.

The davit itself is thrown outwards, on its pivot, under the control of screw gear, but the foot of the davit itself is in the form of a toothed quadrant, the teeth engaging in a rack in the base of the apparatus. The davit can be made of practically any form, straight or curved, so that the boat when stowed can lie in any convenient position. When the boat is to be lowered its weight is taken in the usual way by the falls. It is lifted clear of the chocks upon which it has been stowed, and the davits and boat together are swung outboard to the full extent of the quadrant. In the outboard position the outboard end of the quadrant is against the outboard part of the frame carrying the davit, and the fulcrum upon which the davit works is also against the outboard end.

The davit can be designed to give whatever clearance from the ship's side is necessary, and it lends itself to the stowage

of boats in various convenient positions that would be impossible with ordinary davits. In some cases, for instance, the boats are stowed half outboard, thus giving a larger promenade space on the deck, a great convenience in the large passenger liners. In another form, the boat is stowed right inboard on

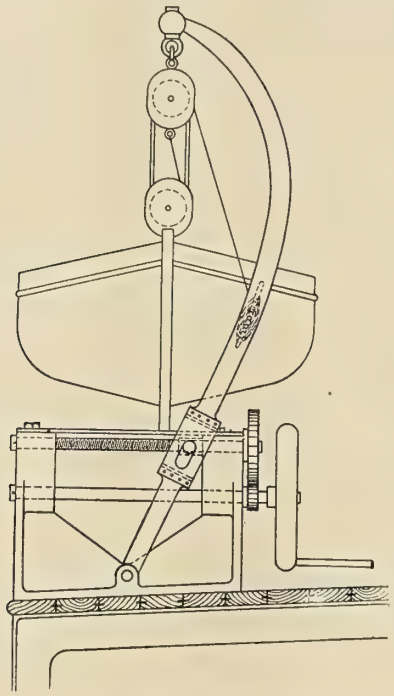


FIG. 1.—BEVIS DAVIT.

top of the cabin, and the davit is made to move through an arc of something like 90 degrees or more, picking the boat up from its stowing place, raising it in the air, carrying it outboard to the position where it can be safely lowered, and in recent installations two boats can be carried under a single set

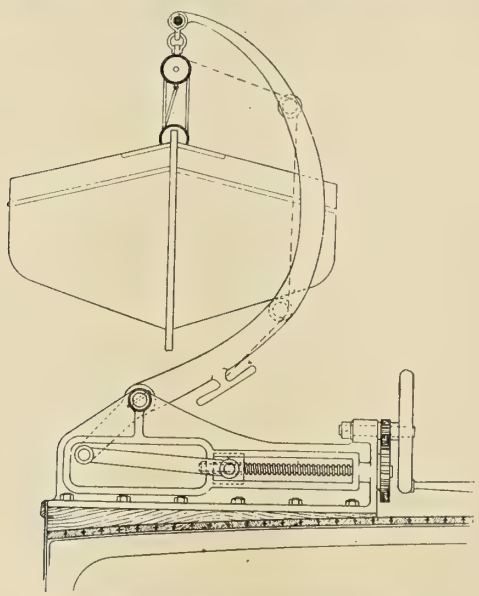


FIG. 2.—MESSAGERIES MARITIME DAVIT.

of davits. In addition to other arrangements the falls have a balancing action, as usually arranged by Mr. Welin, so that in the case of lifting heavy boats they assist the hoisting gear at some part of the lift, as shown in Fig. 4.

An important development also is the special arrangement for handling heavy launches on board of cruisers. The launch has to be stowed well inboard, practically in the equivalent position of that occupied in the old sailing ships, and it has to be lifted from this position and turned right outboard. The operation is the same as we used to perform in old sailing ship days, by combined tackle from the fore and main yards and fore and main masts. In the old days when getting a launch our four tackles were employed, two from the fore and main masts and two from the fore and main yard arms. The tackles from the fore and main masts lifted the boat out of its crutches to a sufficient height to enable it to pass over the hammock nettings. When it was sufficiently high the tackles from the fore and main yard arms were hauled out, and as they took possession of the boat the tackles from the fore and main masts were eased off till the boat hung from the yard arm tackles by which they were lowered into the water.

DISENGAGING APPARATUS.

The problem involved in lowering a boat at sea, particularly in a seaway, has two parts. It is necessary, as explained above, to provide room between the end of the davit and the

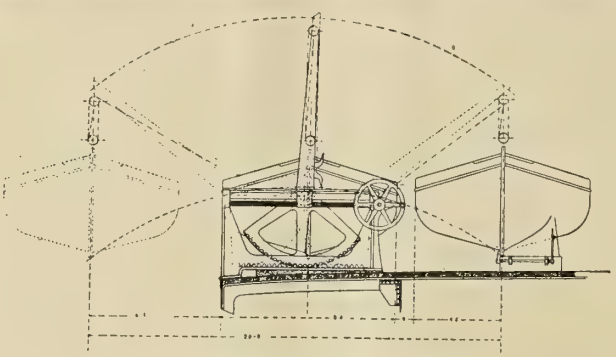


FIG. 3.—WELIN DAVIT WITH 90° QUADRANT.

ship's side, so that the boat will have a chance of swinging clear even if the ship does roll back, and in addition it is necessary to arrange that the boat is instantly disengaged from its falls immediately it touches the water. In certain cases it may be wise even, where it can be done, to disengage before the boat touches the water. Where the ship is rolling quickly, or with a very long roll, if the boat is not actually in the water when the back roll commences it is often a safer plan, where it can be done, to drop the boat from a short distance into the water than to risk her coming up against the ship's side again. In any case the boat must be disengaged immediately she touches the water, or there may be very serious trouble, as the boat may be pulled violently in against the ship's side, or possibly pulled out of the water again and seriously damaged.

There are several appliances on the market for disengaging the boat immediately it is water borne. In all of them the weight of the boat is made use of to keep the suspending gear locked in place, and the absence of its weight, immediately it is water borne, is made use of to enable the suspending gear to be disconected from the falls. For ordinary boat hoisting the usual arrangement is: the boat is hung by a pair of chains, fixed forward and aft in the boat. Both chains are secured to the keelson, and the forward chain is also secured to the stemson, the after chain being secured to the stern post. Each chain has an eye to receive a hook, or to which any disengaging apparatus may be attached. The chains are kept in the center of the boat, so that when hoisting the boat swings level by lanyards between the rings of the chains and eye-bolts in the sides of the boat.

The hoisting gear consists of one of the usual ship's tackles. There is usually a double sheave block below, and in the old sailing ship days there were two sheaves fixed in the davits above, the fall being passed round the two sets of sheaves. With iron davits a second two-sheave block is suspended from the davit to take the place of the sheaves in the old wooden davit. In harbor, where boats are being continually hauled up

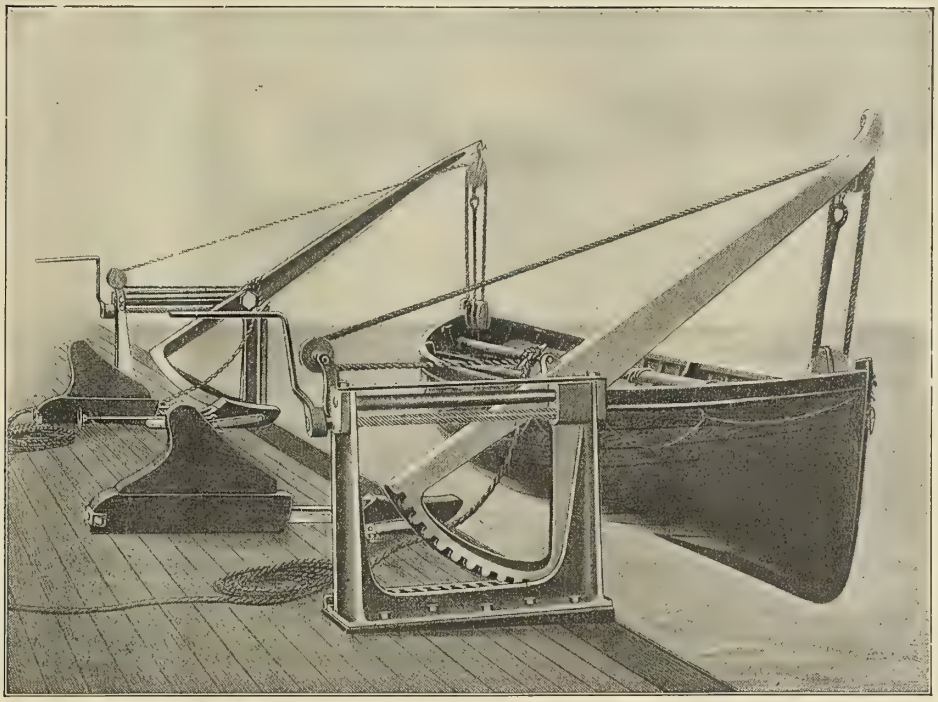


FIG. 4.—WELIN DAVIT, SHOWING BOAT ABOUT TO BE LOWERED.

and down, as in men-of-war, the lower block of the falls carries a hook, which engages with the eye in the chain of the boat, and the boat is hoisted by pulling the two falls together. In men-of-war a sub-division of the watch, or if it is to be done quickly, the whole of the watch would be mustered on the falls. Each fall would be hauled taut separately, the two falls "married," as seamen express it, the men catching hold of both of them together, and run quickly up to the davits. With the heavy boats used in modern battleships the boats are hoisted by winches, usually driven by electric motors, but the same arrangement rules. When the boats are up the ends of the falls are secured around cleats, placed in convenient positions on the davits or just inside the ship. For lowering rowing boats in harbor in men-of-war all that is required is a hand at each fall, a couple of hands in the boat, to keep her off the ship's side and to take charge of her when she is in the water. The hands at the falls allow them to run round the cleat as the boat descends, the cleats being used as brakes till the boat takes the water. With the heavy boats the arrangement would be the same, except that the boat would be swung out and lowered by the winch under control of a brake, and, if necessary, of the electric motor.

FIG. 5.—BOAT DRILL WITH WELIN DAVITS ON STEAMSHIP EUROPE.

At sea it is different. The lower blocks of the falls have eyes, or thimbles, in place of hooks, and the chains in the boats have various forms of hooks engaging with the eyes of the falls, and arranged to disengage instantly when the coxswain or the officer in charge desires. The apparatus employed is, broadly, of two kinds. There are always hooks, but in some forms of disengaging apparatus the hook is made to tumble clear of the eye when the boat is water borne, and in other cases it has to be pulled out, so as to release the eye.

In the Linkleter apparatus, drawings of which are shown in Fig. 6, it will be seen that there is a tumbling hook. Attached to the suspending chain in the boat is a casting, with a slot,

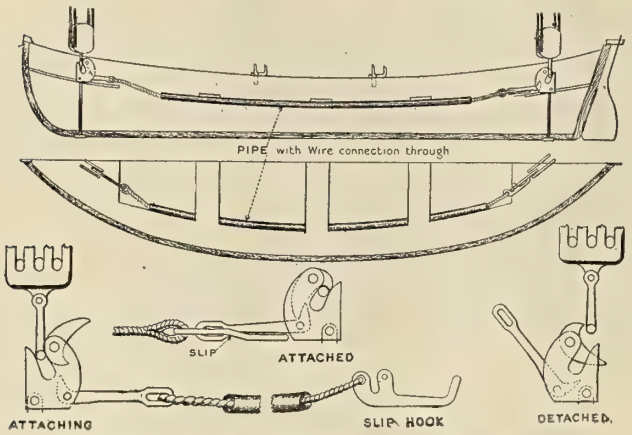


FIG. 6.—DETAILS OF LINKLETER DISENGAGING APPARATUS.

into which the eye of the falls slips, and out of which it can slip easily when allowed to do so. When in place, and the boat is to be hoisted, the tumbling hook shown is turned over and locks the eye in position. The tumbling hook and the slotted fittings together form a ring, holding the ring of the falls so long as the hook is in the locked position. The tumbling hook is kept in the locked position by the second hook shown. The fitting which locks the tumbling hook is really another tumbling hook. It is pivoted upon another pin in the slotted fitting, and when the falls are to be held in place the slip hook, as it is called, holds one end of the tumbling hook, as shown in the drawings, so that it cannot move backward, and therefore holds the eye of the falls in place. The slip hook is kept in its position by the device shown. An eye in the end of the hook is passed over a lug in another fitting attached to a rope running fore and aft in the boat, and is held in its place by a pin. The rope passes through a pipe in the boat, and is conected to the two slip hooks fore and aft. It is slipped by releasing the after hook. When the boat is water borne the after hook is slipped, both slip hooks are then released, and the eyes of the falls are free to push the tumbling hooks holding them in place back to slip out of the slots, and the boat is free. The slip hook is put in operation by the coxswain, or the officer in charge of the boat, and he must judge the instant when it can be done with advantage. Upon his judgment depends the lives of those in the boat.

The Mills disengaging apparatus shown in Fig. 7 has also a

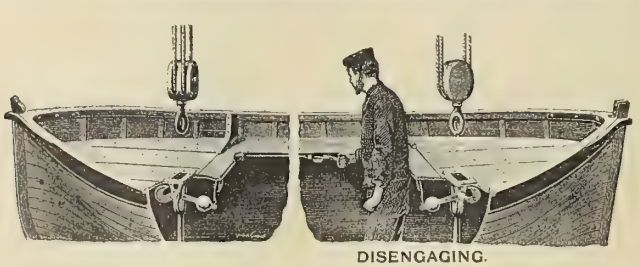


FIG. 7.—MILLS DISENGAGING APPARATUS.

tumbling hook. The arrangement is somewhat different than that of the Linkleter. The falls have the eyes, as in all cases, and the boats in place of the chains described for suspending them have stanchions fixed in the keelson, forward and aft, the stanchions ending in crutches with slotted plates above them. In the crutches are pivoted the tumbling hooks, and the slotted plates above are to hold the eyes of the falls in position. The tumbling hook is very simple indeed in arrangement. It consists merely of a lever, with a hook at one end and a balance weight at the other. Attached to the balance weight is a rope leading over pulleys to the center of the boat, the ropes from the two hooks being connected together, and to a handle, which the man who is to release the boat grasps. This is the apparatus, the only one so far as the writer is aware, which enables the boat to be released before it is water borne.

The usual arrangement is, when the boat is to be hoisted, the eyes of the falls are pushed down through the slots in the stanchion plates in the boat, and the hooks are engaged with them, the hook and the slotted plates together forming a sufficient lock, so long as the weight of the boat is upon the falls. When the boat touches the water, and its weight is taken off the falls, the coxswain, or whoever is to release the boat, pulls sharply upon the ropes attached to the two tumbling hooks, causing the hooks to fall backwards, releasing the blocks, and with it the boat. The boat, therefore, can be released before its weight has been taken by the water if sufficient force can be brought to bear upon the tumbling hooks to release them from the eyes of the blocks.

Hills disengaging apparatus differs from the others in the fact that the hook has to be pulled clear when the boat is water borne. As the writer understands, it is not possible to disengage the boat so long as its weight is upon the falls. As will be seen by the drawings (Figs. 8 and 9) there is a stanchion, forward and aft, somewhat similar to that with the

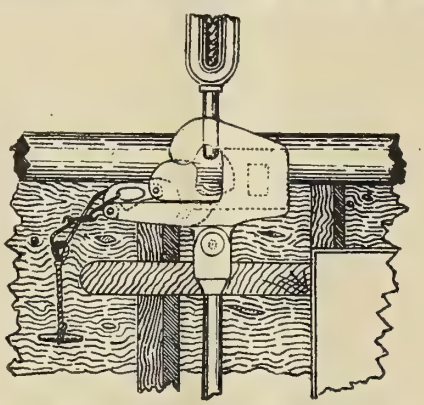


FIG. 8.—HILLS DEVICE CLOSED AND LOCKED.

Mills apparatus, the stanchion carrying a slotted fitting above in which the engaging and disengaging apparatus is fixed. The main slotted fitting, it will be seen, nearly forms a hook. It is a hook, providing there is no vibration, and that something is present to prevent the eye of the falls slipping over the end of the hook. The eye of the falls is kept in position, when the boat is at the davits, by the sliding piece shown in Figs. 8 and 9, which forms with the main portion of the fitting a complete eye or ring just as the tumbling hook does in the Linkleter.

When the boat is at the davits, and the weight of the boat is on the falls, the eye is locked in the compound ring formed by the fitting. Disengaging is performed by pulling the sliding piece out of the main fitting, the action of pulling this out also bringing the eye of the falls out and providing it with clearance. The two sliding fittings, the one forward and the one aft, are connected together by a rope, and can be released by pulling on the toggle at the end of the rope after it has

passed through the block, or the boat can be released by simultaneously pulling on the two short pieces of rope, using the toggles for the purpose.

Another form of releasing hook on slightly different lines made in America is the Raymond. It has a tumbling hook attached to the lower block of the fall of a special form, which

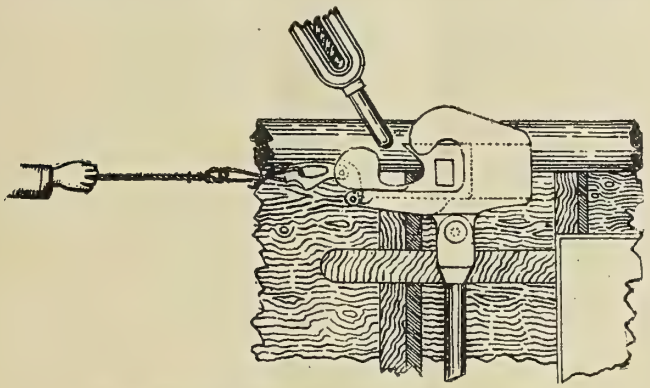


FIG. 9.—HILLS DEVICE UNLOCKED AND DISENGAGED.

it is claimed releases very easily. The bill of the hook carries a lanyard, by which hooking on when the boat comes alongside is facilitated, the lanyard assisting in turning the tumbling part of the hook over. The lanyard is also employed to mouse the hook when the boat is at the davits. Another feature of this apparatus is, the falls are in one continuous length, not in two, as is usually arranged, so that though there are two hands lowering it is not easy for either end of the boat to be lowered before the other. The standing parts of the falls are carried through blocks arranged for the purpose, either attached to the end of the davits or to a spreader fixed between the davits. To the middle of this part of the falls also is attched what is practically a life line, a lanyard secured to the middle of the fall, which is useful to catch hold of when the boat comes alongside. The hooks tumble as usual when the boat is water borne.

One important point in all forms of disengaging apparatus is that the two falls shall be disengaged together, and the makers of all the apparatus claim that it is impossible for one fall to be disengaged without the other. As in other cases the secret of success with all of these devices lies in keeping them in proper order.

BOAT DRILL.

One of the most important factors in connection with saving life at sea is being prepared when the occasion arises. Broadly, there are two occasions that have to be provided for—the case of "man overboard" and the case of wreck. For both it is necessary that boats shall be ready to lower instantly, that their crews shall be ready to man them, that whatever arrangements are made for lowering them, for throwing them outboard, so as to give them room for lowering and for disengaging, should always be ready for instant use, and all this is only to be obtained by frequent practice. Boat drill is, or should be, one of the most important parts of the routine of every ship, large or small. In too many cases lives are lost and other disasters occur because when boats are wanted, and they are always wanted at very short notice, the men who should handle them are not familiar with the work they are to do, and the apparatus itself is not always in proper order. A great deal can be done in ten minutes if everybody knows his place and if the apparatus is all in working order.

The eighteenth annual meeting of the American Society of Naval Architects and Marine Engineers will be held at the Engineering Societies' Building, 29 West Thirty-ninth street, New York City, Nov. 17 and 18.

THE FIRST ITALIAN TURBINE PASSENGER STEAMER.

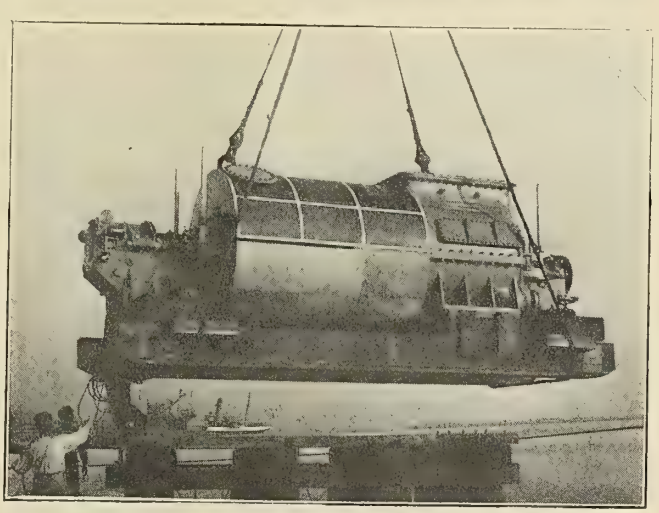
BY DAGNINO ATTILIO.

The *Citta Di Catania,* which ran her full speed trials on June 25, is the first Italian steamer fitted with turbine machinery constructed in Italy. She was built at the yards of Messrs. Gio. Ansaldo Armstrong & Company, at Sestri Ponente, to meet the requirements of Italian Shipbuilding Regulations (Registro Italiano), under order of the State's Railway Department, for passenger service between Naples and Palermo. The general particulars of the vessel are as follows:

Length over all	363 feet.
Length between perpendiculars	346 feet.
Breadth	41 feet.
Depth	30 feet.
Corresponding displacement	3,400 tons.
Speed in service	20 knots.
Designed speed on trial	22 knots.
Shaft horsepower	12,000

PROPELLING MACHINERY.

The turbine-propelling machinery is of the Parsons type, having the three-shaft arrangement now usually adopted for merchant steamers, with one high-pressure turbine coupled to the center line of shafting, and one low-pressure ahead and and an astern turbine incorporated in the same casing coupled to each wing shaft. The starboard and center propellers are right-handed, and the port left-handed. The diameter of the rotor drum of the high-pressure turbine is 3 feet 11¼ inches, the low-pressure 5 feet 6 inches, and the stern rotor drum 4



STARBOARD LOW-PRESSURE TURBINE OF THE CITTA DI CATANIA.

feet 2 inches. Each line of shafting drives one solid manganese bronze propeller.

The turbines of the *Citta Di Catania* are the first set for an Italian passenger steamer, and are the first set manufactured by Messrs. Gio. Ansaldo Armstrong & Company in their works at Sampierdarena, since they obtained the right for manufacturing the Parsons turbine in Italy. The rotor wheels are cast steel, the spindles of forged steel of special quality and the casing of cast iron. The blades are of hard-drawn brass, and are fixed in the rotors and casings in accordance with Parsons usual design.

The adjusting blocks, which are incorporated in the turbines, are so constructed that they admit of being readily adjusted while the turbines are running. The handles of all

starting and maneuvering valves for the ahead and astern turbines are accessible from the starting platform at the forward end of the engine room, and are operated entirely by hand, so that one engineer can have entire control of the whole machinery. With this arrangement the port or star-

LAUNCHING OF THE CITTA DI CATANIA.

board turbine is capable of being worked ahead or astern independently of each other and of the high-pressure turbine, the latter rotating idly when maneuvering.

The lagging of the turbine casings is arranged on an improved design, the result being a very small loss of heat by radiation. This result is obtained by supporting the magnesia lagging blocks so as to give an air space of about 4 inches between their under surface and the surface of the casings.

A governor, working in conjunction with the high-pressure turbine throttle valve is fitted at the forward end of the turbine bearing. It is driven by worm gear from the rotor spindles. The governor on each shaft is arranged to act independently and close the throttle valve in the event of the shaft breaking, or the speed of the turbines exceeding the limit at which the governors are set (600 revolutions), owing to the propellers racing in a seaway.

Chadburn's patent counters and tell-tales are fitted to the forward end of the turbine, and are so arranged that the engineer on watch can, from the starting platform, see not only the direction of rotation of each shaft, but also the number of revolutions of each shaft.

Each low-pressure turbine exhausts into a separate condenser of the Uniflex type, with steel plate shells, the total cooling surface in the two condensers being 8,998 square feet.

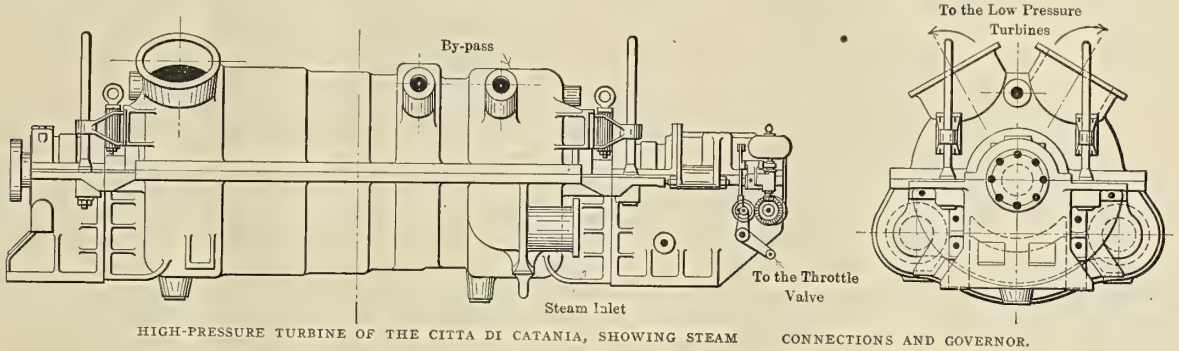
The two circulating pumps are of the centrifugal type, each driven by a separate reciprocating engine, 11 1/16 inches in diameter by 11 1/16 inches stroke; the suction and delivery pipe being 23 inches diameter; the wheel is 44 inches in diameter, and runs at 225 revolutions. The air pumps are of Weir-Dual's latest type for wet and dry air suction; the diameter of each pump is 22 inches and the stroke 16 inches. The exhaust steam from the auxiliaries is led into a surface heater, through which the feed water is circulated on its way to the boilers. The feed water is passed through a filter, and is then delivered to the boilers by one pair of Weir's double-acting pumps, 13 inches diameter and 26 inches stroke. Two of Weir's direct-acting pumps, 5 inches diameter and 12 inches stroke, are fitted for supplying oil under pressure to the turbines, one for ordinary working and the other for stand-by purposes. One Weir direct-acting pump, 8 inches diameter by 10 inches stroke, is fitted for circulating water into the oil cooler. There are also one 20-ton pump for sanitary use for washing decks, one 60-ton pump for See's ash ejectors, one 70-ton pump for fire, bilge and ballast purposes, and one 6-ton pump for fresh water.

There are also two large self-lubricating, steam-driven dynamo sets. The distilling plant consists of one Bonsignori evaporator, capable of producing from sea water 20 tons of fresh water per twenty-four hours. There is an auxiliary condenser located just beyond the main condenser, fitted with water circulating and air pumps, each situated at the ends of the steam cylinder and working in a horizontal position.

SPEED TRIAL.

On the six hours' trial the ship mantained, with ease, an average speed of 23 knots, and on a portion of the run her speed was 23.4 knots, the mean power, measured with a Denny & Johnson's torsion meter, placed on each shaft, being 13,600 horsepower, and the coal consumption 1½ pounds per horsepower per hour. The air pressure in the boiler furnaces was ¾ inch of water. The number of revolutions was 510, and identical in the case of all three turbines, a remarkable fact, which shows that the radial *blade clearance* in the turbines, *especially,* is actually *as designed.* During the trial the *dummy clearance* in the high-pressure and low-pressure turbines, measured by *micrometers* and controlled by *finger-pieces,* was .02 inch and .024 inch, respectively; the steam pressure in the port of high-pressure turbine was 150 pounds and 23 pounds in the low-pressure turbine, just in the annular space before the first expansion; the steam pressure in the boilers was 180 pounds per square inch, while the condenser vacuum was 27½ inches. The opening of the stop valves on the boilers was only *two turns corresponding to half of the full opening.* More opening caused priming. The temperature of the oil in the bottom of the turbine bearings was 110 degrees F.

Absolutely no vibration was felt in the ship, as the greatest care was taken in the static and dynamic balancing of the rotors, and it can be justly claimed that the first turbine merchant ship built in Italy represents a new triumph for the Parsons turbine system.



HIGH-PRESSURE TURBINE OF THE CITTA DI CATANIA, SHOWING STEAM CONNECTIONS AND GOVERNOR.

Steam is supplied by ten single-ended boilers, 14 feet 1¼ inches diameter by 11 feet 2⅝ inches long, with three Morison furnaces, 3 feet 10½ inches outside and 3 feet 7⅜ inches inside diameter in each. The working pressure is 170 pounds per square inch, the grate area 614 square feet for the ten boilers, length of grate 5 feet 9⅜ inches, and heating surface 26,050 square feet. There are 372 tubes in each boiler, with an outside diameter of 2¾ inches and 8 feet 2½ inches in length. The steam chamber contains 3,531 cubic feet, and the stop valve is 4⅝ inches in diameter.

The boilers are arranged in three compartments; four in the central and aft compartments and two in the fore compartment; there are three elliptical funnels; two of them measure 8 feet 10 inches by 6 feet 9 inches, and the other 8 feet 10 inches by 4 feet 7 inches. The funnels are double, the space between the inner and outer funnel being utilized for ventilating the boiler rooms and stokeholes. The boilers work under Howden's forced draft system; air being provided by five large fans, driven by suitable closed self-lubricating steam engines. See's ejectors are fitted, one for each group of boilers, while for harbor duty two steam ash-hoisting engines are provided.

The propellers are three-bladed, of the following dimensions, viz.: Diameter, 6 feet 6¾ inches; pitch, 5 feet 10 11/16 inches; projected surface for three blades, 20 square feet; developed surface, 22 square feet.

COLUMN TABLES FOR SHIP WORK.

BY R. EARLE ANDERSON.

In pursuance of its policy of bringing about, as far as practicable, uniformity of practice in the design of details on vessels building for the United States navy at the various shipyards, the Bureau of Construction and Repair has recently issued a set of column tables, arranged with particular reference to the requirements of ship work.

The work of preparing these tables, under the general direction of the officer in charge of design work, fell to the writer, who found it necessary, in order to determine the proper basis for the construction of the tables, to undertake a general review of existing experiments, formulas and professional opinions relating to the strength of compression members.

With the exception of a few tests of a limited nature made at the Norfolk navy yard and referred to later, no tests were undertaken, because where existing data did not cover the ground as fully as might have been desired (as for example in the case of columns of brass, bronze, etc.), the number and extent of the tests that would have been required to constitute really reliable data were such as to render it impracticable to make them. It should be noted that while a very small number of tensile tests will give a satisfactory index to the corresponding characteristics of a material, the same is

not true in the case of column tests, small groups of such tests being frequently misleading. The failure fully to appreciate this fact has been responsible for much of the diversity found in the various accepted column formulas.

It is believed that the review of information relative to column strength, and the conclusions drawn therefrom, will be of interest. There are appended tables of least probable ultimate strengths of columns of various materials. The writer is not aware of the existence of any column tables equally as extensive as these in the range of materials covered. It is upon these tables of least probable ultimate strength that the construction and repair tables of safe unit loads are based. The ultimate strengths are not given in the construction and repair tables, because, owing to the somewhat unusual method adopted of applying the factors of safety as explained below, it was feared that some confusion might result.

REQUIREMENTS FOR SHIP-WORK COLUMN TABLES.

In the preparation of tables of allowable column loads for use in connection with work on ships certain fundamental principles should govern:

(*a*) The tables should have a wide range of applicability. Their use will not be similar to that of tables or formulas intended for bridge design or for structural steel work generally. The latter purposes have formed the basis of the column tables and formulas now generally in use by the engineering profession. In the design of a single, large and important structure, such as a large bridge, careful consideration can be given to the conditions which will obtain for the compression members, and the formulas can be modified accordingly. No such detailed consideration can be given to the various cases of compression members occurring in ship work. It is not probable that secondary stresses will be cared for to any extent in the detail designs, and the tables must therefore contain an allowance for such secondary stresses as are likely to occur.

(*b*) The range of applicability should be great, not only as regards the use to which the column or strut is to be put, but also as to the length ratios. It is unusual in structural engineering practice to meet with values of l/r much beyond the range of 25 to 100, the common values lying close to 50. For the range of uses to be met with in ship work, l/r may run from 25 to 250, and the tables should be reliable to 300. The fact that most compression members in ordinary structural engineering practice have l/r near to 50, has led to the adoption of some formulas which are reasonably reliable only between narrow limits, *i. e.*, 25 to 100.

(*c*) The tables should be applicable to the following range of materials: Wrought iron, cast steel, medium steel, high tensile steel, the several grades of steel used for forgings, the various brasses and bronzes, oak, ash, yellow pine, Douglass fir (Oregon pine), white pine and spruce.

(*d*) Tables are preferable to formulas because more convenient for general office use. The formulas upon which the tables are based need not therefore be simple in form. The desirability of simplicity in formulas where they are to be used as such instead of being tabulated has led to the adoption for general engineering use of several formulas not otherwise entirely advantageous.

(*e*) Finally, the tables should be arranged for use with various factors of safety, giving safe loads that will provide the same relative strength for compression members as for tension members when the design is based upon any allowable tensile stress.

TEST DATA.

Practically all reliable published tests on compression members up to 1900 are collected and cited by Moncrieff (Trans. Am. Soc. C. E., Vol XLV.). The materials and the number of tests for each material are as follows: Cast iron, 281; wrought iron, 2,059; mild steel, 230; hard steel, 30; yellow pine, 99; white pine, 66; oak, 49.

It will be seen that by far the greatest number of tests have been made on wrought iron, and practically all accepted formulas and tables rest mainly on the wrought iron tests. The above tests include both small and large specimens, the greater number being small. They include integral and built-up sections, with all types of ends.

The most important of the above tests are those of Hodgkinson (1840), Christie (1884), Tetmajer and Marshall (1887). Other tests included in the above summary were made by Bauschinger, Bouscaren, Strobel, Dagron, Lanza, Kirkaldy, Lamonde and the Watertown Arsenal. For references to original authorities see the bibliography in a later section.

Since 1900 a number of tests have been published which do not greatly change the relative number of tests available for the different materials. A few tests on large members of nickel steel have been made (Waddell). The Quebec Bridge Commission tested a single model of a chord member of the Quebec Bridge, one-third size. The test proved that the detailing of the member was faulty.

The American Society for Testing Materials has outlined a comprehensive series of tests of columns. These tests are being carried out at the Watertown Arsenal; a small part of the programme has been completed and the results published. These tests will be discussed later under the heading "Fixed and Flat Ends."

A number of tests have been made by Prof. Lilley, and are discussed in *Engineering* for Jan. 10, 1908. The original description of these tests has not been available. The tests were made with a view to determining the effect of the shape and relative dimensions of the cross section. A similar set of tests on seamless tubing was made by direction of the Bureau of Construction and Repair at the Norfolk navy yard. The Lilley tests and the Norfolk tests are discussed under the heading "Effect of Form and Thickness."

PRESENT ACCEPTED FORMULAS.

In the discussion of all formulas the following symbols will be used, and formulas as given by the various authorities are changed to agree therewith:

p = Average load per square inch on the column.
P = Total load.
f = Stress per square inch in the extreme fiber.
f_t = Ultimate tensile strength of the material in pounds per square inch.
E = Modulus of elasticity.
e = Eccentricity.
r = Radius of gyration in inches.
l = Length of column in inches.
y = Distance from neutral axis to extreme fiber.

All the formulas discussed in this section are (where not otherwise stated) for ultimate unit loads.

(*a*) *Euler's Formula.*—This is a rational formula applicable only to long columns which may fail by bending without causing a crushing stress in the most stressed fiber; that is to say, the column fails by elastic instability. It was published by Euler in 1759. The formula is derived by determining the relation between the load and the deflection when this relation is such that any increase in the load will cause the deflection to become infinite. The formula assumes that a small deflection does take place, which is then increased by the load, and that the load is truly central; also that the column is free from any resistance to bending at the ends. The formula is as follows:

$$p = \frac{\pi^2 E}{(l/r)^2}$$

On substituting the value of π^2

$$p = \frac{9.87 E}{(l/r)^2}$$

Authorities differ as to the value of l/r below which this formula is inapplicable. Some put this as low as 100 (Johnson's straight line formula intersects a modification of Euler's curve at $l/r = 100$). The authorities which consider Euler's formula applicable to relatively low values of l/r generally average the results of experiments rather than take the lower limit of the experiments; this matter will be discussed later. Comparison with formulas and experimental data considered later in this paper indicates that Euler's formula gives practically correct results for the ultimate strength when l/r is greater than 175.

Attempts have been made to apply Euler's formula to various types of ends by putting an empirical constant in place of π^2 (T. H. Johnson, Trans. Am. Soc. C. E., Vol. XV.). The results are not rational nor satisfactory, nor is the method necessary.

The elastic curve according to Euler's formula is a curve of sines.

(*b*) *Rankine's Formula.*—This formula was originally proposed by Gordon. Rankine modified the formula to the form in which it is now used. The formula was based on Hodgkinson's experiments on small wrought iron and cast iron specimens. This basis has remained without serious amplification. It is the formula given in most of the handbooks, including Carnegie and Cambria, and is the basis of the general column tables in these books, although for the tables given in the handbooks, for particular forms of columns, such as those made up of Z bars or channels, some modification of the straight line formula is generally used.

Rankine's formula is as follows:

$$p = \frac{f_t}{1 + C\ (l/r)^2}$$

The constant C is purely empirical, and is intended to represent both the material and the type of ends. The formula can be derived rationally but the assumptions made in its derivation are not really justified. The term f is usually taken at less than the ultimate strength of the material, and hence becomes an empirical constant. The entire formula is thus to be considered as empirical. It is generally taken as applicable to all values of l/r, but as it intersects Euler's curve at $l/r = 95$ (in the case of medium steel, pin ends), and is much above Euler beyond this value, it should not be considered as generally applicable to all values of l/r. This formula *averages* results of tests. Carnegie gives the formula for medium steel, pin ends, as follows:

$$p = \frac{50{,}000}{1 + \frac{l^2}{1{,}800\ r^2}}$$

The formula contains no factor for eccentricity and assumes the elastic curve as an arc of a circle.

(*c*) *Johnson's Straight Line Formula.*—This formula is confessedly empirical, and represents an attempt to express the average of test results by means of the simplest possible formula. The result is a straight line, tangent to Euler's curve. The equation to the straight line is:

$$p = K - C\ l/r$$

He takes K as the strength at $l/r = O$, and determines C from the relation necessary to make the line tangent to Euler's curve. For wrought iron, round ends, he gives as the equation to the straight line:

$$p = 42{,}000 - 203\ l/r,$$

and for Euler's curve uses $E = 27{,}000{,}000$. The point of tangency is at $l/r = 135$. For other materials and types of end, the point of tangency varies from $l/r = 75$ for cast iron with round ends to $l/r = 210$ for wrought iron with flat ends.

He compares his formula with the then available (1885) data on cast iron with round and flat ends, wrought iron with flat, hinged and round ends, mild steel with flat ends, hard steel with flat ends and oak with flat ends.

As the constants for each of these materials have to be separately determined for each material, there is not a satisfactory basis for passing from one material to another for which complete experiments are not available.

Johnson gives, in addition to his formula for the average of each set of experiments, a formula for a lower limit and one for an upper limit. To do this he modifies the constants in the straight line formula and changes E in Euler's formula. To modify E does not seem rational.

This straight line formula, variously modified, has become the most accepted formula in American practice, principally because of its simplicity and consequent convenience. For the limited range required for bridge and similar work it is sufficiently accurate.

Mr. C. C. Schneider (Quebec Bridge Report) criticizes the formula as being too high for $l/r = O$ and too low at its point of tangency to Euler's curve.

Accordingly, he proposes the following modifications, basing his strength at $l/r = O$ on results found by Tetmajer:

Wrought iron, $p = 43{,}100 - 183\ l/r$, $(l/r \leqq 112)$.

Medium steel, $p = 45{,}700 - 165\ l/r$, $(l/r \leqq 105)$.

These are for pin ends.

The American Railway Engineering and Maintenance of Way Association adopts the formula in the following form for *safe loads:*

$$p = 16{,}000 - 70\ l/r$$

(*d*) *Pencoyd Tables.*—These are based on the tests made by Christie (Trans. Am. Soc. C. E., Vol. XIII., 1884) on relatively small specimens of wrought iron, medium and hard steel, with various types of ends The majority of the tests were on wrought iron. The tables are apparently intended to average the results. They do not plot into a fair curve. The tables for safe loads include a factor of safety which increases with increase in l/r. The curve for round ends lies much below Rankine's formula, the value being about one-half at $l/r = 150$. The curve is practically coincident with Johnson's original straight line formula from $l/r = 50$ to $l/r = 125$, and beyond 125 it is close to, though slightly below, Euler's curve.

(*e*) *Comment on Accepted Formulas.*—It is evident from the above that none of the formulas in common use fulfills the requirements laid down at the beginning of this article.

Euler's equation is correct for very long columns only, most of which lie beyond the range of usefulness.

Rankine's formula is to be regarded as entirely empirical; it gives too high values for the longer columns even within the range of greatest use; its original basis of test data is insufficient; and it gives no satisfactory means for passing from one material to another. With the possible exception of the straight line formula, Rankine's formula is the most used column formula in existence, which is unfortunate, as it is the least accurate of all (provided the limited applicability of Euler's formula be allowed for), and generally gives results which are much too high.

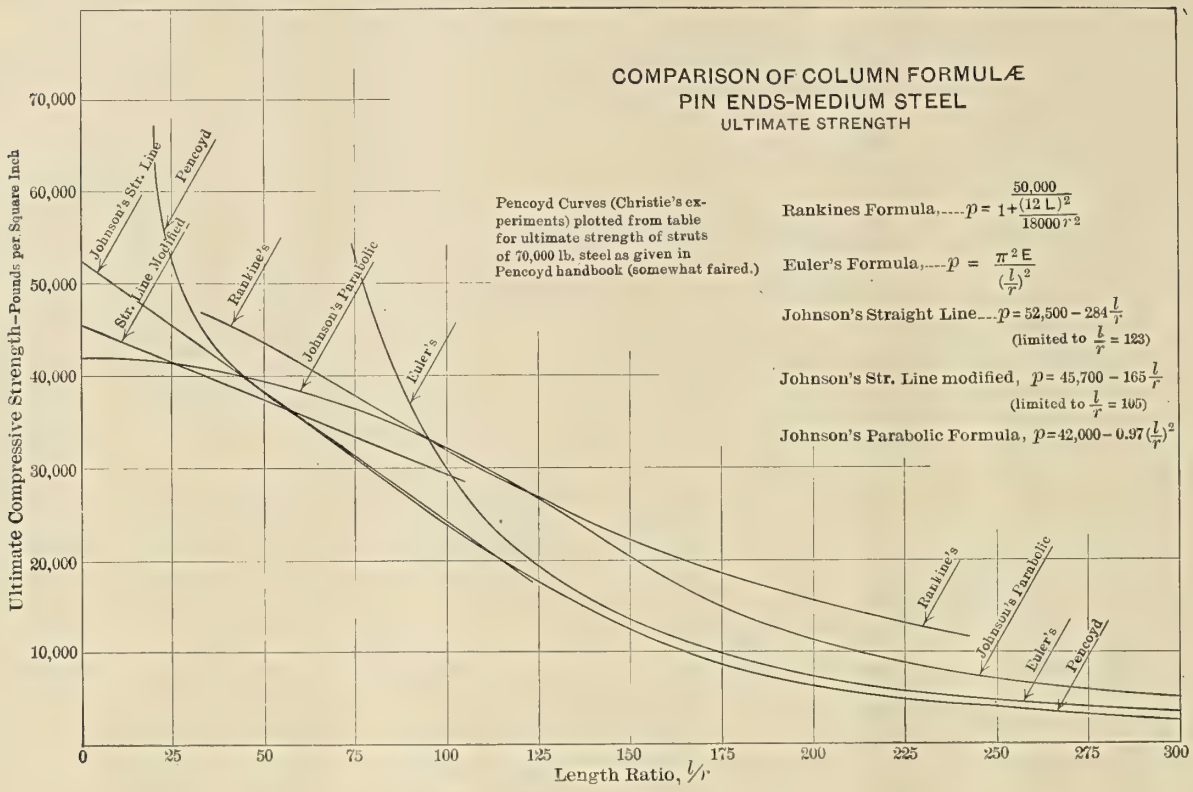


FIG. 1.

Johnson's straight line formula, while extremely useful for the purposes for which it was intended, is limited in its applicability as to both material and range of l/r, and a satisfactory basis for passing from one material to another is lacking.

The Pencoyd tables are based purely upon experiment, and hence, while trustworthy for the actual materials represented in the tests, give no means of passing from one material to another.

All of the above formulas and tables are open to criticism, also because they are intended to average the results of tests rather than to assign a lower limit to them. This will be discussed in the succeeding section.

The various formulas are shown in the form of curves in Fig. 1, from which their great divergence is apparent.

(To be continued.)

THE MARINE STEAM ENGINE INDICATOR—XV.*

BY LIEUT. CHARLES S. ROOT, U. S. R. C. S.

The admission line, *AB* of Fig. 95, shows how steam is admitted to the cylinder. The admission line should be straight, vertical and at right angles to the atmospheric line, and can usually be made so if the valve is open a proper amount to steam when the crank pin is crossing the dead center. At this part of the crank revolution the piston is practically at rest or moving very slowly, and a small opening is sufficient to run the pressure up to that of the valve chest. As the piston moves away from the cylinder end its speed rapidly increases, reaching a maximum at about half stroke, and if the valve is at all late in opening it is easily seen that it will be impossible to run up the pressure instantly in a space whose volume is rapidly increasing, and this through the small area of the initial valve opening. If the valve is thus delayed in opening the admission line leans inward and decreases the area of the diagram to no useful purpose.

The proper form is shown at *VI*, Fig. 96. This is a portion of a card taken from the high-pressure cylinder of a compound engine fitted with Corliss valves. The steam valve opens at *A*, with the piston practically on the dead center, the pressure runs up at once, but not so quickly that the inertia of the pencil motion of the indicator carries the pencil beyond the height due to the valve chest pressure, which will cause a sharp point at the top of the admission line as at *B* on diagram VIII. This sharp point is one of the indications of too much lead; *lead* being defined as the opening of the valve to steam when the engine is on the dead center. Diagrams I to V were taken from a slide-valve engine, whose valve gear was purposely deranged to show the effects of bad valve adjustment. Diagram I was taken with the valve set so that all the events would be very late. The exhaust port closed at *C* just before the engine reached the center, compressing the imprisoned steam and causing the pencil to rise a little. The piston then commenced to move to the right, the steam expanding, and in consequence causing the pressure to drop, the pencil going around the loop in the direction of the arrows. The pressure continued to fall until it reached the point *A*, when steam was admitted and the pencil rose slowly, as shown. By the time the piston reached *A* it was moving at considerable speed, and as the valve was open only a small amount at first the pressure could not rise instantly, thus causing the admission line to lean to the right. The engine was stopped, the eccentric advanced and diagram II taken. This resulted in earlier compression and admission, as shown. The eccentric being again advanced the events were still earlier and the loop had almost disappeared, but there was no lead and the admission line still leaned to the right. At *IV* a small amount of lead was given, and the admission line found to be correct, the line being vertical with no point at the top. The valve was then given excessive lead and diagram V resulted. At *C* compression commenced, the pressure in-

* Copyright, 1910, by Chas. S. Root.

creasing before the advancing piston until the pencil reached *A*. At this point the valve opened to steam, but the pressure being higher in the cylinder than in the valve chest, the steam blew back into the latter, the inertia of the mechanism carrying the indicator pencil below the chest pressure. The pencil shows the true pressure at *B* as the stroke commences.

Diagram VII is from a Corliss engine, and shows too little lead, VIII being from the same engine and showing too much lead, the admission line leaning to the left. Diagrams IX and X were taken from a high-speed engine driving a dynamo, and show late openings to steam in both cases as well as excessive compression.

The setting of valves on single-valve engines is more or less of a compromise, any alteration of the eccentric or valve stem lengths causing alterations in all of the valve events. Generally speaking, the lead should be the least amount which will produce a vertical admission line with a slightly rounded corner at the top. If circumstances are such that the line must lean in either direction it should be in the direction shown in diagram VIII, as this helps towards a good port opening, which will in turn assist in maintaining the steam line at its proper height. It is the usual custom to adjust the valve stem or spindle length in such manner that the lead will be greatest on the bottom, but the difference, if any be necessary, must be determined by the indicator.

(*To be continued.*)

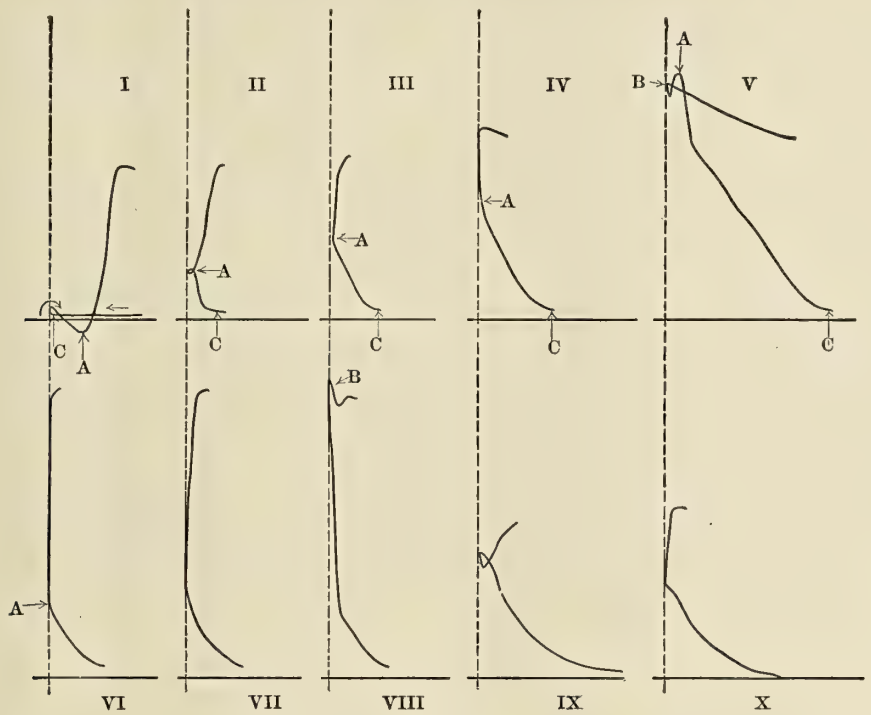


FIG. 96.

According to the plans of the engineer-in-chief of the United States navy, an experimental producer gas plant will be fitted on one of the new colliers, if congressional authority can be obtained for the diversion of a portion of the appropriation for steam machinery. Efforts in this direction, however, will not be made unless such an expenditure shall be deemed advisable by the authorities. There is every reason to believe that a suitable and efficient gas producer plant could be built at the present time for one of the new colliers, and, in view of the value of the data which would be obtained from its performance, such an experiment would be well worth trying.

TORPEDO BOAT DESTROYER ROE.

Ten torpedo boat destroyers, the *Paulding, Drayton, Roe, Terry, Perkins, Sterret, McCall, Burrows, Warrington* and *Mayrant,* were authorized by act of Congress, approved May 13, 1908. All of these vessels, which are now building or completed, are fitted with steam turbines and are designed for burning oil fuel. The *Perkins* and *Sterret* have Curtis turbines, the *Mayrant* and *Warrington,* Zoelly turbines, and the other six vessels have Parsons turbines. They all have closed fire rooms.

The contract for the *Roe* and *Terry* was awarded to the Newport News Ship & Engine Building Company, of Newport News, Va., in October, 1908. The contract time was twenty-four months and the price $620,000 (£105,000), which is exclusive of equipment, etc.

The contract requirements were:

Length over all	293 feet 10½ inches.
Length between perpendiculars	289 feet.
Breadth	27 feet.
Mean draft	9 feet.
Coefficient of fineness, block	.41
Capacity of fuel oil tanks	210 tons.
Displacement	742 tons.
Total horsepower	12,000
Speed	29½ knots.

Armament: Five 3-inch 50-caliber semi-automatic guns, three 5-meter by 45-centimeter deck torpedo tubes, three 3-inch guns; all of which are furnished by the government.

PROPELLING MACHINERY.

The propelling machinery consists of seven Parsons steam turbines, operating three shafts. The center shaft is driven by the main high-pressure turbine, and the two wing shafts are each driven by one low-pressure turbine, which, within the same casing, also contains a backing turbine. Forward of each low-pressure turbine, and connected to the rotor shaft by a flexible coupling, are the high-pressure and intermediate-pressure cruising turbines. The wing shafts turn outboard when

going ahead and the center shaft turns in the same direction as the starboard wing turbine. All of the turbines, together with the auxiliary machinery, are placed in one compartment. The turbine operating valves, together with steam strainer and the stop valves to the main steam lines from the boilers, are placed on the forward engine-room bulkhead.

The condensers are cylindrical with packed tubes, the circulating water being furnished by independent circulating pumps. There are two double vertical, single-acting air pumps and auxiliary condenser with combined air and circulating pumps. Two main feed pumps are placed aft near the feed tank. In the engine room are placed, also, two evaporators and one distiller, a feed heater, two 6-kilowatt turbine-driven dynamos, two lubricating oil pumps with oil cooler and oil cooler circulating pumps and a fire and bilge pump.

BOILERS.

There are four Thornycroft (new type) watertube boilers, with tube ends submerged under the water level of the steam drum. The boilers are placed in two compartments, fore and aft, with one fire room in each. The oil fuel tanks are located forward of the forward boiler compartment, and the oil-settling tank abreast of the boilers. The oil burners are of the Thornycroft type, and consist of eleven oil sprayers, the oil being sprayed by mechanical atomization without the use of either steam or compressed air jets. The air required for combustion of the fuel is supplied to each boiler room by two turbine-driven Sirocco forced-draft blowers. The oil-burning arrangement is in all essential details similar to that described in a general way in an article—"Modern Torpedo Destroyers"—which appeared in the August number of International Marine Engineering.

Each boiler has about 4,500 square feet of tube heating surface with 460 cubic feet of furnace space. Each oil heater has about 67 square feet of heating surface. The vessel has three smokestacks, of which the center stack takes the gases of combustion from the two middle boilers.

PROPELLERS AND SHAFTING.

The diameter of rotor shaft journals is 7 to 9 inches, and the line shafting is 6¾ inches outside diameter, with a 3½-inch inside diameter. The propellers are made of Monel metal, with blades and hub in one piece. The diameter is 5 feet 3 inches, and the pitch is 4 feet 10 inches, with a total projected blade area of 13 square feet.

TRIAL DATA.

The standardization trials were made on a course off the Delaware Breakwater, on July 12 and 13 last, and the official speed trials on July 14, 15 and 16, on a course off the Virginia Capes.

On the four-hour full speed trial the maximum speed of 29.7 knots was attained on a mean displacement of 711 tons.

Mean revolutions of turbines = 795.

Pressure in boiler = 239 pounds gage.

Pressure in main high-pressure turbine = 217 pounds abs.

Pressure in high-pressure cruising turbine = 2.5 pounds abs.

Pressure in intermediate-pressure cruising turbine = 5.0 pounds abs.

Pressure in low-pressure main turbine = 49.6 pounds abs.

Vacuum = 27.5 inches, with 30 inches barometer.

Pressure in fire rooms = 3¼ inches.

Horsepower, main turbines, = 11,790.

Water per hour per shaft horsepower of main turbines = 16.92 pounds.

Horsepower of auxiliaries = 500, about.

Nautical miles per ton of fuel (2,240 pounds) = 4.43.

Pounds of fuel oil per hour = 14,937.

British thermal units per pound fuel oil = 19,388.

Slip of propellers, mean, = 22 percent.

Pounds of water evaporated per pound of oil = 13.358.

On the twelve-hour 16-knot trial the following data were obtained:

Revolutions per minute all turbines, 380.

Pressures in main high-pressure turbine steam belt, 27.2 pounds abs.

High-pressure cruising turbine steam belt, 211 pounds abs.

Intermediate-pressure cruising turbine steam belt, 62 pounds abs.

Low-pressure main turbine steam belt, 10.3 pounds abs.

Vacuum (barometer 30.2), 29.3 inches.

Shaft horsepower, all turbines, 1,490.

Horsepower auxiliaries, 140.

Water consumption per shaft horsepower-hour turbines, 25.61 pounds.

Pounds water per pound of fuel oil = 12.00.

Nautical miles run per ton of fuel oil, 11.37.

Slip of propellers, mean, 10.5 percent.

Speed, average on run, 16.85 knots.

On the twelve-hour 25-knot trial the following data were obtained:

Revolutions per minute, all turbines, 646.

Pressure in main high-pressure turbine, 115.7 pounds abs.

High-pressure cruising turbine, 2.53 pounds abs.

Intermediate-pressure cruising turbine, 260.8 pounds abs.

Low-pressure main turbine, 8.11.

Vacuum (barometer 30.12), 29.35

Shaft horsepower, all turbines, 7,122.

Horsepower auxiliaries, 255.

Water consumption per shaft horsepower of turbines per hour, 16.31 pounds.

Water evaporated per pound of fuel oil = 13. pounds.

Nautical miles run per ton of fuel oil, 6.38.

Slip of propellers, 17.2 percent.

Speed, average on run, 25.5 knots.

The Mordenwood.

Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, have recently built a steel screw steamer of the following dimensions:

Length	342 feet 3 inches
Breadth	47 feet
Depth	24 feet 9 inches

The vessel is classed 100 A1 at Lloyds, having main deck, poop, bridge and T. C. forecastle. Accommodation for the captain, officers and engineers is in houses on the bridge deck, and for the crew in the forecastle.

The vessel has double bottom on the cellular principle for water ballast. She is fully equipped with an up-to-date outfit, including quick-warping steam windlass, stockless anchors, steam-steering gear amidships, and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include six steam winches, steam being supplied by a large donkey boiler. The holds are entirely clear of obstructions to stowage of cargo, having center line pillars only. This is a construction which has been found to give the best service in a cargo steamer of this size and type.

The engines are of the triple-expansion type by Messrs. Blair & Company, Ltd., Stockton-on-Tees, of about 1,300 indicated horsepower. Steam is supplied by two steel boilers, 15 feet 3 inches by 10 feet 3 inches, working at 160 pounds steam pressure.

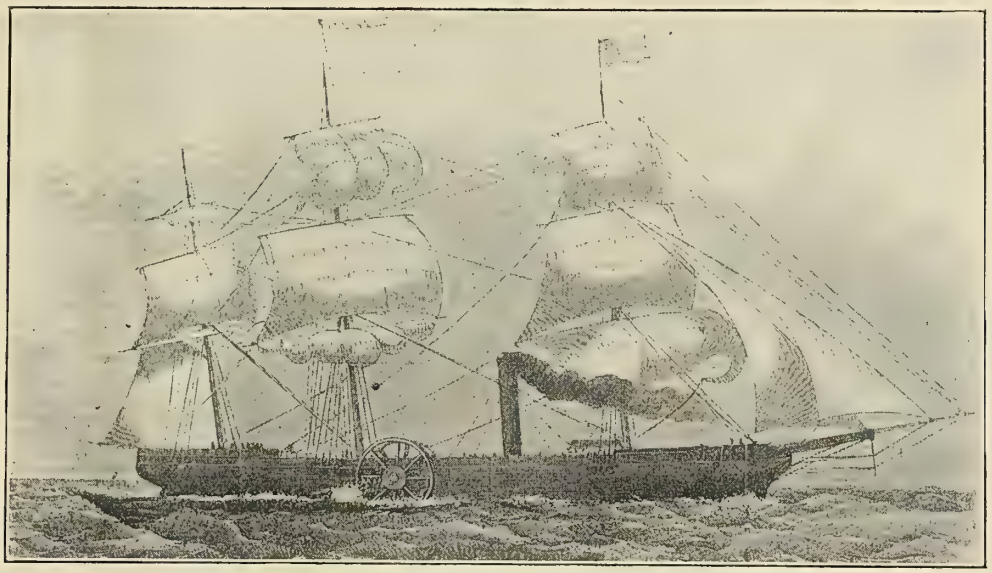
The vessel has been built to the order of Messrs. Constantine & Pickering Steamship Company, Middlesbrough, and has been named *Mordenwood*.

OLD AMERICAN TRANSATLANTIC STEAM LINERS.

BY FRANCIS B. C. BRADLEE.

In the following article we shall confine ourselves to a sketch of the early attempts at transatlantic steam navigation, to be followed by an account of the various lines started at one time or another by Americans. Into the general history of transatlantic steam navigation we shall not enter; such would be impossible in the limits of one article.

To the present generation the old-time side-wheel steamers are little more than names, and yet, in their day, they were ships of great size, great power and considerable speed. They were indeed ships which did much credit to their builders and owners. John Fitch, who built at Philadelphia in 1787 the first steamer worthy of the name, while praising his hobby to visitors, made use of the following words: "This, gentlemen, whether I bring it to perfection or not, will be the mode of crossing the Atlantic in time for packets and armed vessels." After which, one visitor said to the other, "Poor fellow, what a pity he is crazy!"



THE SAVANNAH, FIRST STEAMSHIP TO CROSS THE ATLANTIC OCEAN (1819).

Robert Fulton, who first made a commercial success of steam navigation with his *Clermont* on the Hudson in 1807, is said to have built a steamer called the *Emperor Alexander,* which he intended to send across the Atlantic and sell to the Russian Government, but the breaking out of the War of 1812 frustrated his design. To Robert Fulton, however, is due the credit of having designed and built for the United States navy in 1814 the first war steamer in the world, a huge floating battery called the *Demologos.* She measured 2,475 tons and steamed 5½ miles an hour against the tide on the only sea trip she made, which was from New York to Sandy Hook and return in July, 1815. Had the *Demologos* only been finished a year sooner she might have changed the world's method of naval warfare, as the *Monitor* and *Merrimac* did fifty years later.

The first steam vessel to cross the Atlantic was the *Savannah,* built in 1818 at Corlears Hook, in the city of New York, by Crocker & Fickett. The *Savannah* was a ship-rigged side-wheel vessel of 380 tons, 130 feet long, 26 feet beam and 16½ feet depth of hold. Her 90 (indicated) horsepower, low-pressure engine, of the inclined, direct-acting single cylinder type, was built by James P. Allaire of New York, and cost about $3,500 (£720). The cylinder was 40 inches in diameter, with a 5-foot stroke, giving her a speed of about 5 knots under steam alone. The engine was in the 'tween decks and the boilers in the lower hold. Her coal consumption was about 9 tons per day, and on her passage to England she carried 75 tons of coal and 25 cords of wood. No passengers or cargo were carried on this voyage. Her paddle wheels were not boxed in and were so arranged that they could be easily detached from the shaft and taken in on deck in rough weather.

This memorable voyage of the *Savannah* from America to England was begun May 24, 1819, when she sailed from New York to Savannah. From Savannah she proceeded direct to Liverpool, where she arrived after a passage of eighteen days, during seven of which she was under steam. Her arrival in England caused much excitement, and she was visited by great numbers of people, including many persons of distinction. As she had been built with the sole idea of selling her to the Emperor of Russia, she soon departed to Elsinore, on her way to St. Petersburg. On the voyage she touched at Copenhagen and Cronstadt, and was visited by the King of Denmark, the Emperor of Russia and other noted persons. She was not sold, however, as had been expected, and sailed for home, arriving at Savannah after a voyage of 22 days. On account of the high price of fuel she carried no steam on her return passage, and the wheels were taken off. At the completion of the voyage the *Savannah* was purchased by Capt. Nathaniel Holdrege, and in 1820 was divested of her engine, which was bought by James P. Allaire, its builder. She was subsequently used as a sailing packet between Savannah and New York, and went ashore on Long Island and broke up in 1821.

Capt. Moses Rodgers, the commander of the *Savannah,* died in the forties on the Pee Dee river, North Carolina. He is believed to have been the first man that ran a steamboat either to Philadelphia or Baltimore.

Relative to the disputed claim of Americans to the honor of sending the first steamer across the Atlantic, an English newspaper, at the time of the arrival in New York of the steamship *Sirius* in 1838, printed the following: "The practicability of the undertaking (navigating the ocean by steam) was, in fact, already proved by American skill; the question now to be settled is its economy and its superiority to the usual mode of navigating; and this, we admit, will be due to British enterprise."

John Kennedy, in his History of Steam Navigation, Liverpool, 1903, says: "On the 5th of October, 1820, the steamer

Conde de Patmella, Capt. Silva, sailed from Liverpool for the Brazils. She made a remarkably rapid passage to Lisbon, arriving there in four days. This is probably the first steamer that ever crossed the Atlantic Ocean from England."

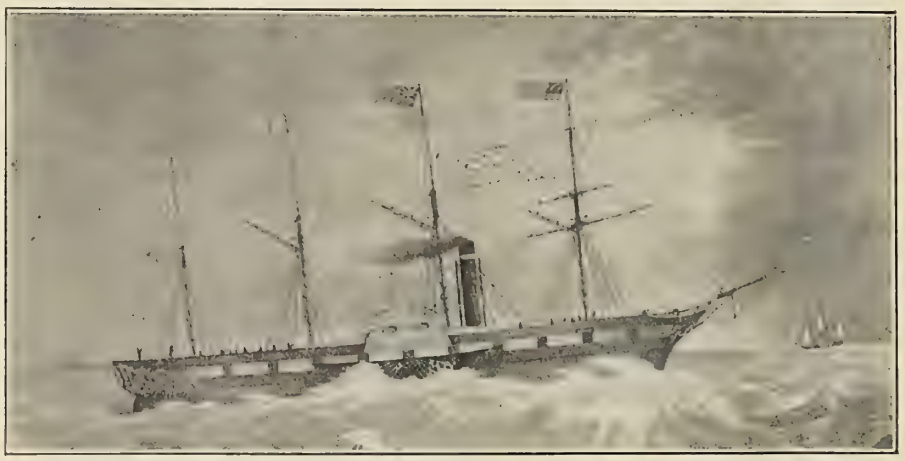
In 1825, the steamer *Enterprize* made the voyage from London to Calcutta. She left on August 16, under the command of Lieut. Johnston, R. N., with 17 passengers, and arrived on December 7 following, thus making the passage in 113 days, during 64 of which she was under steam. The *Enterprize* was a wooden paddle-wheel steamer, built of wood by Messrs. Gordon & Company, Deptford, at a cost of $210,000 (£43,000). Her length was 122 feet, beam 27 feet and she registered 479 tons. She had a copper boiler in one piece which weighed 32 tons and cost $34,000 (£7,000). Her engines were 120 horsepower (nominal), and were capable of propelling her at the rate of 5 knots in smooth water. The *Enterprize* was sold to the East India Company soon after her arrival at Calcutta, and used by them as a transport and despatch vessel.

Arthur J. Maginnis, in the "Atlantic Ferry," London, 1900, says that a Dutch steamer, called the *Curacoa,* of 350 tons, 100 horsepower, built at Glasgow, made several voyages between Antwerp and Curacoa in 1829.

The facts about the voyages of the *Conde de Patmella* and *Curacoa* have been much disputed and by some people these two ships have been called myths, but the facts are here given for what they are worth.

In 1820, a ship-rigged vessel of 750 tons, called the *Robert Fulton,* fitted with a "cross-head" engine (similar to those on the early Long Island Sound steamers), was put on the route between New York and New Orleans, stopping on the way at Charleston and Havana. The *Robert Fulton* had two boilers and two funnels, and was very successful as an ocean-going steamer, but not so much so financially, so that she was sold to the Brazilian Government in 1823; her engine was taken out and she was used as a cruiser and was afloat as late as 1838.

THE ROYAL WILLIAM, FIRST VESSEL TO STEAM ALL THE WAY ACROSS THE ATLANTIC (1833).



THE GREAT WESTERN (1838), THE FIRST STEAMSHIP TO MAKE REGULAR PASSAGES ACROSS THE ATLANTIC.

In 1830, the *Meteor,* a British steamer, ran regularly as a mail packet between England and the Mediterranean.

As early as 1828, the Valentia Steam Navigation Company was incorporated by Act of Parliament, to establish steam communication between the West of Ireland and America. According to an old circular, the company's first steamer was estimated to cost $103,000 (£21,000). She was to be about 800 tons, driven by engines of 200 horsepower (nominal), and

was expected to make at least six round voyages per annum. There were to be accommodations for 50 cabin and 50 steerage passengers, and 200 tons of freight, exclusive of coal. As nothing more can be learned about this company, it is probable that the whole scheme fell through for want of support.

The first vessel to steam the whole way across the Atlantic was undoubtedly the *Royal William* (first of the name). As many mistakes are made concerning this steamer, some authors confusing her with the *Royal William No. II,* an entirely different ship, that made several voyages between Liverpool and New York in 1838-39, the following account, condensed from a paper read before the Quebec Historic Society in 1894, is believed to be absolutely correct.

The *Royal William* was built of wood at Quebec in 1831, by James Goudie, for the Quebec & Halifax Steam Navigation Company, to run between those two ports. She was 830 tons gross, 176 feet long, 29 feet beam and 17.9 feet depth of hold, and her side-lever engines of 200 horsepower (nominal) were made in England by Boulton & Watt, and fitted in the ship at Montreal by Bennett & Henderson. Owing to the cholera epidemic of 1832 (and perhaps other reasons), the *Royal William* was not a success on the Quebec & Halifax route, and it was determined to send her to England to be sold. Accordingly she left Quebec for London, Aug. 4, 1833, under the command of Capt. John McDougall, and after coaling at Picton, N. S., and Cowes, arrived at London on September 11. She met with very heavy weather on the way, one of her paddle wheels being nearly disabled. In 1834, the *Royal William* was sold to the Spanish Government, made into a man of war, and armed with six guns. It is said she was the first war steamer to fire a gun in action. She was finally broken up, owing to dry rot, at Bordeaux in 1839, and her engine utilized elsewhere. In passing, it is interesting to note that one of the original owners of the *Royal William* was Samuel Cunard, of Halifax, N. S., who afterwards was one of the founders of the famous Cunard line, and it is thought that his interest in the *Royal William* first gave him the idea of starting a line of ocean steamers.

What has been called the real beginning of transatlantic voyages under steam were the first trips of the steamers *Sirius* and *Great Western*, about the facts and dates of which there has been quite a little confusion, and about which various publications differ. It is certain they were the first steamships to make regular trips across the Atlantic, and the facts here given are taken from the newspaper files of the date of their arrival in this country.

The *Great Western* was the larger and more powerful craft. She was owned by the Great Western Steamship Company, and was built of wood at Bristol in 1837 by William Patterson from designs by Isambard Kingdom Brunel, the famous engineer, who afterwards designed the *Great Eastern.* She was 1,340 tons gross, 679 tons net, 212 feet long, 35 feet beam, 23 feet depth of hold, and had four masts, with square yards on the foremast.

Being especially built for the transatlantic service, the *Great Western* was of unusual strength, her bottom being solid and her frame secured with iron diagonal bracing. Her motive power consisted of side-lever engines, built by Maudslay & Sons, of London, having two cylinders, each 73½ inches in diameter, 7 feet stroke; the paddle wheels were 28 feet in diameter, and steam was generated in four iron, return-flue boilers carrying a pressure of 12 pounds to the square inch, horsepower (nominal) 440, horsepower (indicated) 750, speed 8 knots. Her first commander was Lieut. James Hosken, R. N., and afterwards B. R. Matthews.

The *Great Western* left Bristol for New York on the 8th of April, 1838, with seven passengers on board, and arrived at New York on the 23d direct in 15 days. On the voyage out she had averaged 208 miles per day, her best day's run being 247 miles. She carried 600 tons of coal, of which she had consumed 400 tons. Her commander said the voyage had been made in almost a direct line across the Atlantic; that the weather had been good save for continual head winds. The passengers reported the ship's motion so slight on the way out that it was not necessary to put battens on the tables, and only once during the trip were teacups upset.

While the *Great Western* was fitting out at Bristol, a rival company, the British & American Steam Navigation Company (whose principal founder, Junius Smith, LL. D., an American, died in New York in 1853), chartered the steamship *Sirius* from the St. George's Steam Packet Company to make what may be called a voyage of announcement, pending the building of its own steamships, the *British Queen* and *President.*

The *Sirius* was a wooden paddle boat, built for the English-Irish cross-channel trade by Menzies & Company, of Leith, in 1836, and was 703 tons gross, 412 tons net, 178 feet long by 25½ feet broad, and 18 feet deep. The engines were of the side-lever type, built by Wingate & Company, Glasgow, having two cylinders, each 60 inches in diameter, 6 feet stroke; the steam pressure was 15 pounds to the square inch, horsepower (nominal) 320, (indicated) 600. In appearance the *Sirius* was long, straight, and low-lying in the water. She was equipped with distilling apparatus for providing fresh water for her boilers throughout her voyage, and it was said upon her arrival in this country that the distilling worm, or mass of copper pipes, was "four miles long." That statement was printed in the New York papers of that date.

The *Sirius* hauled out of the London docks, Mar. 28, 1838, under the command of Lieut. Richard Roberts, R. N., one of the ablest navigators of his day (in passing it is interesting to note the full list of officers of this pioneer liner: John Dudley, chief officer; G. T. Briggs, R. N., second officer; T. A. Whittaker, H. C. M., R. N., third officer; John Lambert, chief engineer; William Denning, second engineer), and proceeded to Cork Harbor to embark her passengers (40 in number), and at 10 A. M. on April 4, 1838, she sailed for New York. The *Sirius* arrived in New York at 10 o'clock Sunday evening, April 22, and the *Great Western* at 3 o'clock on the Monday afternoon following the arrival of the *Sirius.* Thus the *Sirius* made the voyage in 18 days and the *Great Western,* as before stated, in 15 days. The passengers on the *Sirius* said they delighted with her qualities as a seaboat. As the steamship on nearing New York failed to find a pilot, she ran in without one and grounded off the Hook, but floated again, uninjured, upon the rising tide. Her average speed on the voyage was 161 miles per day, her maximum run being 220 miles, and her minimum run 85 miles. She consumed 450 tons of coal, and ran short before reaching her destination, burning spare spars, resin, etc.

The *Great Western* ran regularly between Bristol, and later Liverpool and New York, until 1847, when she was sold to the West India Royal Mail Steam Packet Company. Her best time, while on the New York route, was 12 days 7 hours from New York to Liverpool. She was finally broken up at London in 1857. The *Great Western* was always a great favorite with passengers, often carrying over 100 cabin passengers (no steerage were taken at this time by the steamers).

The *Sirius* made a second voyage between Cork and New York in June, 1838, under the command of Capt. Stephen Sayer Mowle, and her engineer then reported "that they had not stopped the engines from port to port." At the conclusion of this voyage, being too small for the transatlantic trade, she returned to the English-Irish cross-channel route, and was totally wrecked near Queenstown in January, 1847. In 1899 the main shaft of her engine was at work driving a mill a few miles outside of Cork.

From April, 1838, may be said to date regular transatlantic

steam communication. In April, 1838, the British steamer *City of Kingston* went from Cork to the West Indies, and thence to New York via Baltimore and Norfolk. In speaking of her the London *Times* said: "We shall be curious to learn what effect the climate of the West Indies will have on her engines and boilers."

Owing to the success of the *Great Western* and *Sirius,* the Liverpool Transatlantic Steamship Company was formed by several Liverpool merchants; and it is curious to note that at that early period, before any of the steamers were under a mail contract, it was suggested by the above company that three lines, then in the transatlantic service, should come to an agreement regarding the sailings of their vessels, so as to insure a weekly steam communication with the United States.

The Liverpool Company chartered the *Royal William* (second of the name) from the City of Dublin Steam Packet Company to begin their service. She was a wooden paddle steamer, built in 1836, of 817 tons gross, 175 feet long, with side-lever engines of 400 indicated horsepower. The *Royal William II* was the first transatlantic steamer to have watertight bulkheads, of which there were four iron ones. She made quite a number of voyages between Liverpool and New

THE PRESIDENT, FIRST TRANSATLANTIC LINER LOST AT SEA (1840).

York in 1838-39, which averaged 19 days going to the westward and 14½ days to the eastward.

In October, 1838, the *Liverpool,* a wooden side-wheel steamer of 1,150 tons, 235 feet long, 35 feet beam and 21 feet depth of hold, with side-lever engines having two cylinders, each 75 inches in diameter, 7 feet stroke, especially built for the service by Messrs. Humble & Milcrest, came on the line, but was not a success, being slow and cranky. She plied with more or less regularity until the early part of 1840, when she was sold to the Peninsular & Oriental Company, and lengthened and renamed the *Great Liverpool.* She was totally wrecked off Cape Finisterre on February 24, 1846.

The Liverpool Transatlantic Company also had built by W. and J. Wilson, Liverpool, as a mate to the *Liverpool* a fine, large wooden paddle boat called the *United States.* She was 1,787 tons gross, 235 feet long, with side-lever engines of 420 horsepower nominal, and at the time of her launch on March 7, 1840, was the largest vessel that had ever been built at Liverpool. As far as can be traced, however, from careful searching of old newspaper files, the *United States* never made a trip on the line, but was sold before completion to the P. & O. Company, owing to the financial embarrassment of her owners.

On July 12, 1839, the *British Queen,* the new ship of the British & American Company, sailed from Portsmouth (England) on her first voyage to New York under the command of Lieut. Roberts. She was followed by the *President,* which sailed from Liverpool on her first voyage Aug. 1, 1840, commanded by Lieut. R. J. Fayrer, R. N. Both these vessels looked much like the old-fashioned steam frigates, as they were very high out of water, were heavily rigged, and had long rows of square ports. They are described as being "exactly alike," but the *President* was 2,360 gross (at that time the largest ship in the world), 268 feet long, equipped with side-lever engines by Faucett & Preston, of Liverpool, with 2 cylinders, each 81 inches in diameter, 7½ feet stroke, horsepower (nominal) 540, and indicated about 800, and the *British Queen* (both vessels were built by Curling & Young, on the Thames, and were, of course, wooden side wheelers) was 1,863 tons gross, 275 feet long, 37½ feet beam and 27 feet depth, side-lever engines by R. Napier, Glasgow, having 2 cylinders, each 71½ inches in diameter, 7 feet stroke, 500 horsepower (nominal), and 700 indicated. The interior fittings of both vessels were very luxurious for those days, but from the point of view of speed they were rather a failure (probably from lack of power), especially the *President.* The *British Queen's* best passage was 13 days 11 hours from New York to Portsmouth in August, 1840, and the *President's* best time was 14 days 12 hours from New York to Liverpool, September, 1840.

The *President* was the first transatlantic steamer lost; she left New York for Liverpool on Mar. 11, 1841, commanded by Lieut. Richard Roberts, with 136 souls on board (among her passengers were Tyrone Power the actor and a son of the Duke of Richmond), and was never heard of again. The last seen of her was on the evening of March 12, by Capt. Cole, of the packet ship *Orpheus,* also bound to Liverpool. The *President* was then laboring and pitching heavily in a tremendous sea, and, in the opinion of the captain of the *Orpheus,* she went down that night with all on board. This was quite likely to have been the case, as grave doubts had some time before been expressed as to the *President's* strength owing to her then extreme length.

The disaster to the *President* caused immense excitement on both sides of the Atlantic, and as no cable was then working, rumors of her safety prevailed as late as June, 1841. Owing to the loss of the *President,* and also to the competition of the subsidized Cunard steamers, the British & American Company came to an end in 1841, and the *British Queen* was sold to the Belgian Government.

Regarding the talk so often made later during the war between the Collins and Cunard lines, that no line of mail steamers could exist without a Government subsidy, the following statement, quoted from the "American Review" for January, 1845, regarding the early steamers just mentioned and the Cunarders is interesting: "We have before us the prospectus of the British & American Steam Navigation Company, got up by Junius Smith, Esq., of New York. In that document we find a detailed account of the profits and losses of the *British Queen* and *President,* the authenticity and cordectness of which may be relied on. From this account it appears that these ships never failed to net for their owners some profit until the operations of the Cunard line began, and from that time till the dissolution of the company all profit ceased and every voyage only added to the loss. This fact pretty clearly indicated the chief cause of the failure of the New York lines of steamships."

In October, 1838, the English Government advertised for tenders to carry the mail by steam to the United States *via* Halifax, N. S., the service to be fortnightly in summer and monthly in winter. The Great Western Company tendered, but were much surprised and chagrined when their offer was refused and the one made by Samuel Cunard, of Halifax, N. S., George Burns, of Glasgow, and David McIver, of Liverpool, calling themselves the British & North American Mail Steam Packet Company (later the Cunard line), was accepted. Their tender provided for a service as above, with a branch

line from Halifax to Quebec, to be performed by four steamers of 1,200 tons each, with engines of 400 horsepower (nominal). The compensation or subsidy was $292,000 (£60,000) per annum, soon afterwards raised to $394,000 (£81,000) per annum, and the ships were to be sufficiently strong to enable them to be transformed into men-of-war in case of need.

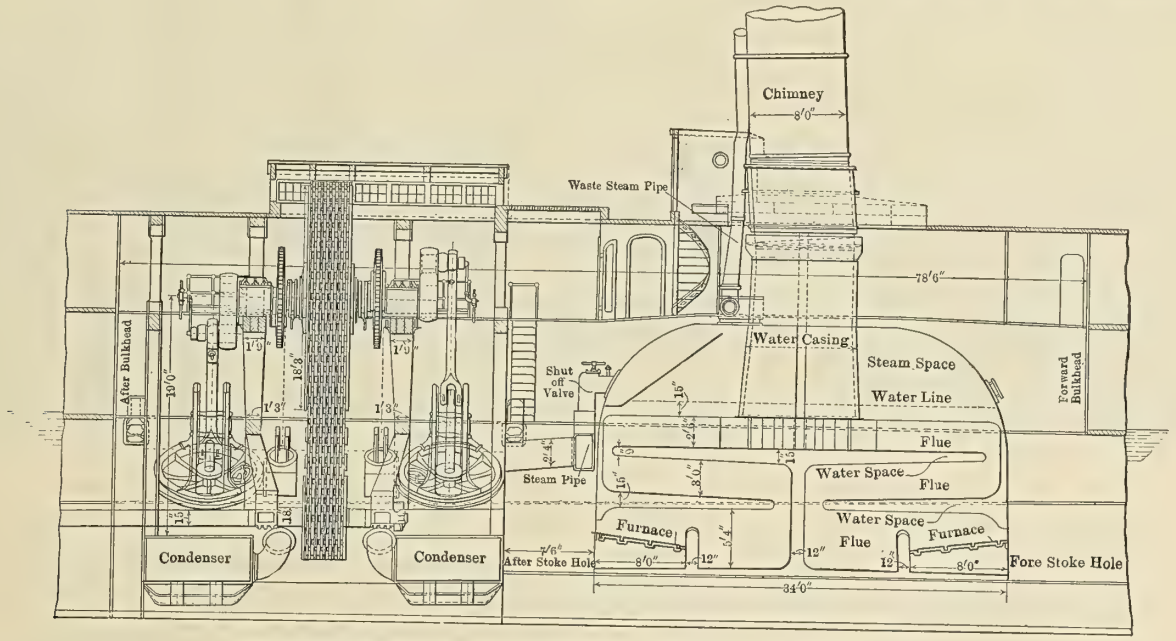
The first four steamers of the Cunard line have been so often written up and described that it will suffice to say here that they were the wooden paddle steamers *Britannia, Acadia, Caledonia* and *Columbia,* all alike, built on the Clyde, 1,150 tons gross, 207 feet long, 34 feet beam with side-lever engines of 740 indicated horsepower; the speed was about 8 knots, and the coal consumption 38 tons per day. On each ship there was accommodation for 90 passengers and 225 tons of cargo. Contrary to general belief, the steamship *Unicorn* was the first of the Cunard fleet to cross the ocean. She was of 649 tons, 570 indicated horsepower (built in 1835 for Messrs. G. and J. Burns' Glasgow & Liverpool service), and was commanded by Lieut. Walter Douglas, R. N., it being the custom of the times to have naval officers in command of the mail steamers, although this practice was soon abandoned by the Cunard Company. She arrived in Boston, June 2, 1840, with 51 passengers.

The Cunard Company was compelled, as already stated, to have its steamers met at Halifax by another, which was to carry the mail to Quebec (this arrangement was discontinued in 1846), and so they sent the *Unicorn* over in advance of their regular boats to take up this Halifax-Quebec service, and having landed her passengers at Boston she returned to Halifax to meet the outward steamer from England.

The first regular steamer of the Cunard line was the *Britannia,* which sailed from Liverpool, July 4, 1840, and she was really the beginning of that wonderful service that has been conducted with unexampled regularity and safety from that day to this. Until 1848, the Cunard boats ran to Halifax and Boston only, but in that year a service was begun to New York, and up to 1868 the steamers ran alternately to Halifax and Boston and New York, but after that the mail steamers all ran to and from New York.

THE GREAT BRITAIN, THE FIRST IRON AND FIRST SCREW OCEAN STEAMER (1845).

After the rejection by the British Government in 1838 of their tender for the mail service, the Great Western Steamship Company were naturally much chagrined, but they determined to build at once another steamer (as a companion to the *Great Western*) that should surpass anything afloat. This was the *Great Britain,* celebrated as the first iron and the first screw ocean steamer. She was designed (as was the *Great Western*) by Isambard K. Brunel, and built by William Patterson at Bristol. She was originally intended as a paddle-wheel vessel, but was changed while building to a screw, and it is interesting to note that the Great Western Company had to undertake the construction of the screw engines themselves, as no private firm could, at that time (1841), be found



LONGITUDINAL SECTION OF THE ENGINES AND BOILERS OF THE GREAT BRITAIN.

who would be willing to build propeller engines of 1,500 indicated horsepower.

The following details of the *Great Britain* are extracted from the "Life of Brunnel." "Total length, 322 feet, length of keel, 289 feet; beam, 51 feet; depth, 32½ feet; draft of water, 16 feet; gross tonnage, 2,984; number of cylinders, 4; diameter of cylinders, 88 inches; length of stroke, 6 feet; weight of engines, 340 tons; weight of boilers, 200 tons; weight of screw shaft, 38 tons; diameter of screw, 15 feet 6 inches; pitch of screw, 25 feet; weight of screw, 4 tons.

"A balanced rudder was a part of her original construction, and the unusual method of lapping the plates will be noticed. Apart from their size, the design of the engines of the *Great Britain* necessarily presented many peculiarities. The boilers, which were six in number, were placed touching each other, so as to form one large boiler, about 33 feet square, divided by one transverse and two longitudinal partitions. It would seem that the boiler was worked with a pressure of about 8 pounds.

"The main shaft of the engine had a crank at either end of it and was made hollow, a stream of water being kept running through it, so as to prevent heating in the bearings. An important part in the design was the method by which motion was transmitted from the engine to the screw shaft, for the screw was arranged to go three revolutions to each revolution of the engines. Where the engines do not drive the screw directly, this is now universally effected by means of toothed gearing, but when the engines of the *Great Britain* were made it was thought that this method would be too jarring and noisy. After much consideration chains were used, working round different sized drums with notches in them, into which fitted projections on the chains."

On July 19, 1843, the *Great Britain* was launched, being christened by H. R. H. Prince Albert, but it was not until Jan. 23, 1845, that she left Bristol for London, making on her voyage an average of 12 1/3 knots. She left Liverpool for New York on August 26, and arrived on September 10, having made the passage out in 14 days 21 hours; she returned in 15½ days, and during the passage home her highest daily run under steam and sail was 331 nautical miles. During the next winter, after one more voyage to New York, alterations were made to give a better supply of steam, and a new screw was fitted. The *Great Britain* made two voyages to New York in 1846, and on September 22 she left Liverpool on a third, but overran her reckoning and stranded in Dundrum Bay, on the northeast coast of Ireland, when it was supposed she was only rounding the Isle of Man.

This unfortunate event completed the ruin of the Great Western Company, which was already in financial straits through the competition of the Cunard line; and the ship, after her rescue, effected Aug. 27, 1847, almost a year after grounding, was sold to Messrs. Gibbs, Bright & Company, of Liverpool, by whom she was repaired and fitted with new auxiliary engines of 500 nominal horsepower. On a general survey being made it was found that she had not suffered any alteration of form, nor was she at all strained. She was taken out of dock in October, 1851, and after a trial trip to New York and back in May, 1852 (making the passage to England in 10 days 23 hours), she was employed regularly between Liverpool and Australia until 1882, when, being unable to compete with the new class of steamers, the *Great Britain* was sold to Messrs. Anthony Gibbs, Sons & Company, who removed the engines and transformed her into a full-rigged sailing ship. She was used as such until 1886, when she put into the Falkland Islands in a leaking condition, was condemned, and is (or was until quite lately) used as a coal hulk there.

(To be continued.)

FIG. 1.—NEW 16-KNOT PORTUGUESE MAIL STEAMER LISBOA.

THE PORTUGUESE ROYAL MAIL STEAMER LISBOA.

The twin screw passenger and mail steamer *Lisboa* was built by Messrs. David and William Henderson & Co., Ltd., at Meadowside, Glasgow, to the order of the Empreza Nacional de Navegacao a Vapor, of Lisbon. The dimensions of the vessel are: Length over all, 452 feet; breadth, 54 feet; depth molded to shelter deck, 37 feet 6 inches, with a gross tonnage of about 7,200. The vessel has been specially designed for the owners' passenger and mail service between Portugal and the Portuguese possessions in Africa, and is fitted with accommodation for first, second and third-class passengers. She is built to class 100 A1 in Lloyd's Registry, and will be one of the largest and most up-to-date vessels flying the Portuguese flag.

The first-class accommodation is fitted amidships, and is of an extremely comfortable and artistic design, with everything

that can add to the comfort of the passengers. It consists of a large dining saloon, drawing room and smoke room, all ventilated and lighted by large dome skylights and square windows. The second-class passengers are placed aft, and they also have been well provided for in the way of comfortable public rooms and staterooms. Forward on the upper deck is accommodation for 142 third-class passengers, and on the same deck aft arrangements have been made for carrying 100 steerage passengers.

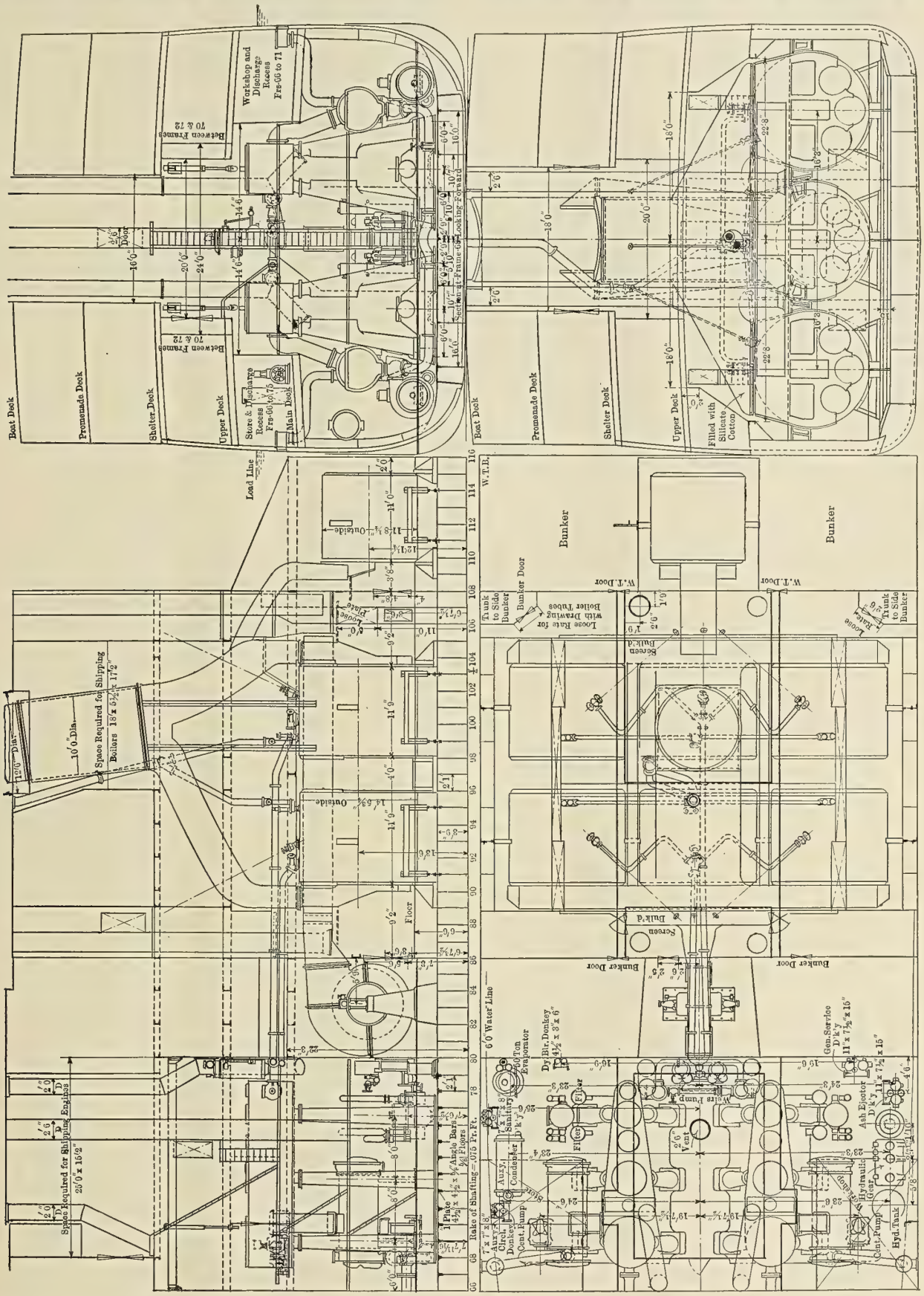


FIG. 2.—SECTIONS THROUGH MACHINERY SPACE OF THE LISBOA, SHOWING LOCATION OF MAIN AND AUXILIARY MACHINERY.

The main engines are two sets of triple expansion engines,

each set having cylinders 25, 41 and 67½ inches diameter, respectively, with a piston stroke of 48 inches, and together with the whole of the machinery they are made to pass the British Board of Trade and Lloyds Registry for a working steam pressure of 190 pounds per square inch, and are fitted with all the latest improvements for securing economy.

The boilers are six in number, 14 feet 3 inches diameter, and 11 feet 9 inches long, and worked with forced draft on Howden's system with all their latest improvements. The furnaces are fitted with Sturrock's Patent Bridges. Heating surface, 13,302 square feet; grate area, 330 square feet. Large condensing surface is provided for tropical climates, and an ample supply of water is insured by an extra large centrifugal circulating pump provided for each condenser, each pump being large enough to supply all the water required for both condensers, which will minimize the risk and delay should either pump break down. The boilers are fed by a pair of G. & J. Weir's pumps and direct contact heater, the feed pumps of the main engines delivering the water to the heater. In addition a large independent duplex pump with gunmetal pump end is provided for feeding boilers and general purposes; a similar pump is also supplied with the same connections as the

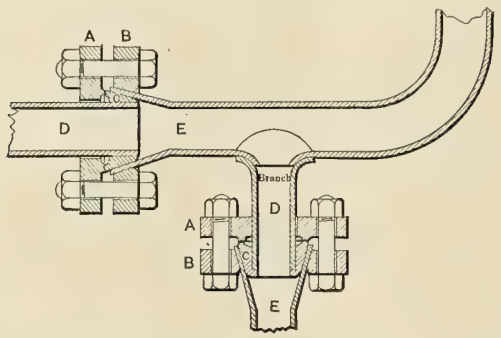


FIG. 3.

feed pump, which insures an ample supply of feed water to the boilers at all times. These duplex pumps are also connected to two See's patent ash ejectors.

A steam ash hoist, by Shanks, of Arbroath, is also fitted. The other auxiliary machinery provided is a large ballast pump, steam reversing gear, steam turning gear, large fan and two engines for forced draft, a duplex pump for feeding the donkey boiler, which has a regulating float tank in connection with it, and a fresh water pump for deck purposes. Two large gunmetal sanitary pumps are driven by the main engines for sea use, and for port use a large duplex pump is provided. There is also an evaporator of the latest type, with connections for use both at sea and in port. Suction filters are provided on each feed pump of the builders' usual design. Beside ample store room accommodation, a workshop is fitted with lathe and drilling machine driven by an electric motor.

The main steam and main feed pipes are of copper fitted with "Geddes" flanges, and a considerable number of Bryce's patent pipe couplings are fitted throughout the vessel. Ample surfaces are provided for all working parts, as the engines are run at high speed. The propellers have four loose blades of bronze fitted to cast iron bosses. A large donkey boiler is provided working at the same pressure as the main boilers, and reducing valves are supplied where necessary for the auxiliaries which require lower pressure than is maintained in the boiler. This boiler provides steam for the engine room auxiliaries and deck cranes and winches, also for the refrigerating machinery and three electric lighting sets.

The deck machinery consists of nine of the builders' own specially strong winches, with 7-inch cylinders and 12-inch stroke, and one with 8-inch cylinders and 12-inch stroke aft, with extended ends and barrels inside the wheelhouse to work relieving tackles for steering in case of need. In addition to these there are four of Messrs. Brown Bros. hydraulic cranes fitted, driven by a set of three crank pumping engines and accumulator situated in the engine room. These engines are of ample power to work all four cranes at one time.

All of the machinery has been specially designed to render the heat of the tropical climates as little harmful as possible to those working in the machinery space, for which purpose a well-designed ventilation scheme is provided, and all parts liable to radiate heat are thoroughly lagged with non-conducting material.

A notable feature in the equipment of this vessel is the adoption of Bryce's improved coupling for copper pipes. From the sketch (Fig. 3) it will be seen that the end of one length of pipe E is bellmouthed and is drawn up on a brass conical ferrule C brazed on the other, and held by flanges A and B fitted loose on the pipes, the flanges being preferably of mild steel stamp forgings, one flange only being machined to the taper required. The copper pipe being closely drawn up between the two harder materials makes a good metallic joint not liable to leak in any way without jointing medium of any kind.

The *Lisboa's* dining saloon is in fumed oak, parquetry flooring, with Wilton carpet runners; the chairs are upholstered in light green Morocco leather. The music saloon is in white Georgian style, upholstered in rose pink tapestry; the floor is covered with india rubber tiling. The smoking room is in waxed walnut, upholstered in brown morocco; floor covered with india rubber tiles. The auxiliary or children's saloon is in white, with fumed oak furniture and light green Morocco upholstery.

The staterooms are upholstered in olive green morocco; the floors are of patent "Keylock" parquetry. The entrance halls and vestibules are of polished teak, with green morocco seats and floor covered with india rubber tiles.

The second-class dining saloon and smoke room are in fumed oak, upholstered in light grey haircloth. A special feature of all the passenger accommodation is the size of the cabins and the width of the alleyways.

During construction the vessel was under the supervision of Mr. T. C. Laws, Liverpool, the owners' representative in this country, and also of Mr. J. A. Edwards, the company's superintendent from Lisbon.

The *Lisboa* ran trials on the measured mile on the Firth, of Clyde attaining a mean speed of 16½ knots, which is one knot more than that stipulated in the contract. She ran a six hours' trial at full speed, and also went through steering and other trials and cruised for a short time in the Firth.

The *Lisboa* will spend practically 90 percent of her time about the equator and to make her thoroughly comfortable, for her passengers required a great deal of consideration. The owners have taken great care that she should give the maximum of comfort even in the warmest weather, and there has been no stinting of space.

The statistical summary of vessels totally lost, broken up, condemned, etc., now published by *Lloyd's Register*, shows that during 1909 the gross reduction in the effective mercantile marine of the world amounted to 866 vessels of 939,232 tons, excluding all vessels of less than 100 tons. Of this total 383 vessels of 645,670 tons were steamers and 483 of 293,562 tons were sailing vessels. These figures exceed those of 1908 by 12,940 tons. This excess is not due to actual casualties, the figures for which show a diminution of 31,471 tons, but entirely to the unusual number of vessels which have been broken up, dismantled, etc. According to the statistics, strandings and kindred casualties, which are comprised under the term "wrecked," are much the most prolific cause of disaster. To such casualties are attributable 53.5 percent of the losses of steamers and 57.5 percent of sailing vessels.

A SINGLE-SCREW TUG AND PASSENGER TENDER.

The single-screw tug, *Flying Kestrel,* has recently been constructed by J. T. Eltringham & Company, of South Shields, for the Alexandra Towing Company, Ltd., of Liverpool. This vessel is of more than ordinary interest, in as much as she is not only one of the most powerful tugs yet built, but she is so designed that when not employed in ocean towing she may be used on the Mersey as a tender for Atlantic liners, and when thus engaged carries 715 passengers with their luggage.

The *Flying Kestrel* is 125 feet in length between perpendiculars, 28 feet 6 inches breadth, molded, and has a depth of 14 feet 9 inches, and is of 390 gross tonnage. She has a straight stem and elliptical stern, flush main deck, sheathed with pitch pine, a 'midship deckhouse, with promenade deck on top about 116 feet long, extending from the stern and leaving a well deck forward. A bridge deck overhead extends from the mast to abaft the coaling hatch.

THE FLYING KESTREL, A NEW SINGLE-SCREW TUG AND PASSENGER TENDER FOR SERVICE ON THE MERSEY.

The first class passenger saloon is on the main deck forward of the boiler space, and extends from side to side of the ship, with entrance from the steel deckhouse on the promenade deck. There is also a saloon under the main deck aft over the watertight flat of the shaft recess. There is a cross bunker between the engine and boiler space with coaling hatch abaft the funnel and side bunkers alongside of the boiler.

Accommodation for the officers and crew is under the forward saloon, with entrance from the port side. There is a separate apartment on the starboard side for the captain, and one on the port side for the engineer, with mess room in the center. The vessel has six watertight bulkheads, stiffened with angles. The main deck is sheathed with 5-inch by 3-inch pitch pine, and the promenade and bridge decks are laid with 4-inch by 2½-inch yellow pine.

The fore and aft peaks have deep floors and wash plates, and are constructed to form fresh water tanks, while the space between the top of the after tank and the main deck also forms a fresh water tank. A fresh water tank is constructed forward of the boiler bulkhead under the forecastle, which is divided into three sections, with deep floors and wash plates. The total capacity of the fresh water tanks is 140 tons, capable of being emptied in one hour.

The propelling machinery has been constructed by the Shields Engineering & Dry Dock Company, Ltd., of North Shields, and consists of a compound surface-condensing engine, 21 inches and 44 inches by 30 inches stroke. The boiler is 15 feet 9 inches by 10 feet 6 inches, and was built by Eltringham & Company for a working pressure of 120 pounds. An electrical installation has been provided by James Scott, Ltd., of Bootle, Liverpool. The engine and dynamo are placed on one bed at the after end of the starboard bunker in the engine room. The engine is an open-front, high-speed vertical steam engine of the double-acting type, with governor and special lubricating arrangement, while the dynamo is of the compound-wound continuous-current type.

The rudder is of the single-plate type. The stock is of the best forged iron, and the arms were shrunk on the main piece and provided with removable pintles. Donkin's steam steering gear is fitted, while the winch, windlass and steam capstans have been supplied by Clarke, Chapman & Company, Ltd., of Gateshead-on-Tyne.

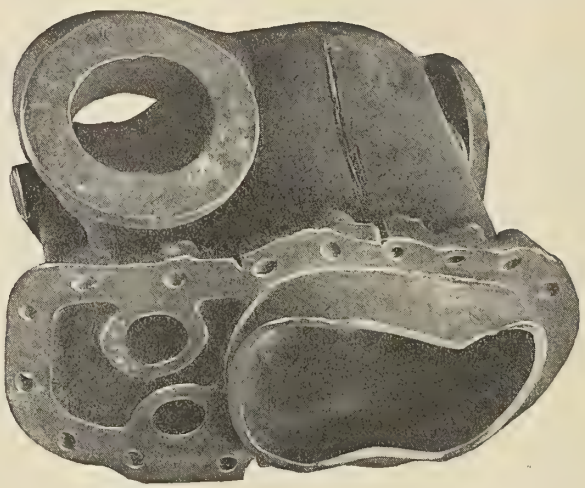
The vessel has been built to Lloyd's special class 100 A-1, and has Board of Trade certificates Nos. 2, 3, 4 and 5.

The largest vessel of the French merchant marine has just been launched at St. Nazaire for the Compagnie Générale Transatlantique. This vessel, which was laid down April 20, 1909, is 722 feet over all, 76 feet beam, 52½ feet depth, with a displacement of 26,000 tons. She will be driven by turbine engines of 40,000 horsepower, designed to give her a speed of 23½ knots.

Obituary.

F. Merian Wheeler, inventor of the Wheeler patent surface condenser, died of heart disease Sept. 15, at Westhampton, L. I. After graduating from the Polytechnic Institute of Brooklyn, Mr. Wheeler took up hydraulic and marine engineering as a specialty, and for over thirty-four years was associated with the George F. Blake Manufacturing Company. He was a director and secretary of the company, and later a director of the International Steam Pump Works, which corporation absorbed the Blake Company, the Worthington and other hydraulic works. Mr. Wheeler organized the Wheeler Condenser & Engineering Company, whose works are located at Carteret, N. J. He has also been officially connected with the Ludlow Valve Manufacturing Company. Mr. Wheeler was a charter member of the American Society of Mechanical Engineers and the Society of Naval Architects and Marine Engineers. He was also a member of the American Society of Naval Engineers and the Engineers' Club of New York.

Vanadium Crucible Steel Cylinder Casting for Torpedo



Elastic limit - - -	**65,000 lbs.**
Tensile strength - - -	**80,000 lbs.**
Elongation in 2 inches -	**22%**
Reduction of area - - -	**43%**

Study these figures and consider that under a steam hammer this Vanadium Steel Casting was distorted as shown without any sign of weakness or fracture.

Vanadium is the most versatile alloy known. Its benefits are astonishing in everything from small iron castings to armor plate; its action is uniform and dependable. It increases tensile strength to begin with, and ends by making wear-proof, anti-fatigue, non-crystallizing, tough and homogeneous parts, whether cast, rolled or forged.

Strength for strength, Vanadium is the lightest steel ever produced. Cost for cost, it is the cheapest.

Booklets, tests, photographs, free.

AMERICAN VANADIUM COMPANY

318 FRICK BUILDING PITTSBURGH, PENNA.

GO AND DO LIKEWISE

Specifications for a new steamship were being decided by the chief engineer of the steamship line and the shipbuilding engineer and during their work the subject of brasses came up.

"I must insist upon Victor Non-Corrosive Silver Metal for the propellers," said the steamship company's engineer. "We have tried all types of bronzes, but this metal is the best because it resists all galvanic action. Zinc strips are necessary with other compositions but none is necessary with the Victor metal. This metal is also very tough and strong, having a tensile strength of 67,000 lbs., and an elastic limit of 45,000 lbs."

"I agree with you there," said the shipbuilding representative, but you will permit us to use our regular bronze for bearings and bushings."

"No," said the engineer, "and I will tell you why." "Several years ago I was looking through the advertisements in a magazine and the following caught my attention:"

STOP

for one moment and estimate the enormous savings in repairs and time you could show in your department by using a bearing metal that would double the present life of your engine bearings.

LOOK

at the wonderful superiority of VICTOR VANADIUM BRONZE over the regular bearing metal used by railroads as shown in comparative test.

LISTEN

to the voice of Opportunity, showing you how the practical elimination of bearing troubles can be attained by the adoption of VICTOR VANADIUM BRONZE.

Comparative Bearing Tests of Victor Vanadium Bronze and other Composition Metals

No. of Bearings	R. P. M.	Load in Lbs.	Time, M.	S.	
1	400	3000	2	15	VICTOR VANADIUM BRONZE
2	400	2000	1	00	Regular Bearing Metal.
3	400	2000	1	15	High Grade Bearing Metal.

Composition No. 2—81% Copper, 9% Tin, 6% Lead, 4% Spelter, Trace of Phosphorous.
Composition No. 3—84% Copper, 12% Tin, 4% Lead, Trace of Phosphorus.

Each of the samples of metals were placed on the machine twice. It will be noted that the time of run checked up exactly in each case. The bearings were placed upon a shaft, 2 15-16" diameter, and the bearing surface in each case was 9 square inches. The speed throughout the test was the same, 400 revolutions per minute, 50% more load was applied to special Victor Vanadium Bronze composition and its time of run was much greater than the other metals. The load applied amounted to 333.33 lbs. per square inch in Special Victor Vanadium Bronze bearing and 222.22 lbs. per square inch in all other bearings.

VANADIUM METALS COMPANY

Frick Building - - - - Pittsburgh, Pa.

"We had such success with Vanadium Steel that I decided to test this Victor Vanadium Bronze Bearing Metal. After some very severe work-outs I adopted this Composition for all my bearings and the results are satisfactory in every respect.

"It is really a marvellous composition metal, embodying not only the essential principles of purity and uniformity of metal and great wearing powers, but also weighs ten per cent. less than any other composition bearing brass of the same dimensions that we have used."

Need We Say More?

VANADIUM METALS COMPANY

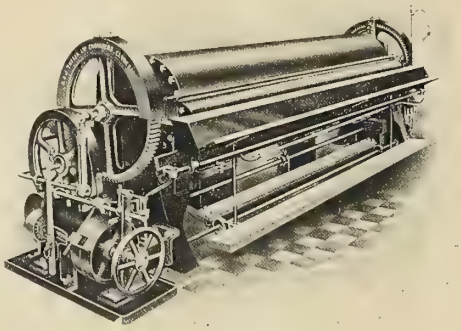
Foundry, East Braintree, Mass. **Frick Building, PITTSBURGH, PA.**

STEAMSHIP LAUNDRIES.

A comparatively recent development in the modern steamship is the equipment of ocean-going passenger vessels with up-to-date power-driven steam laundry plants, capable of dealing effectively with the passengers' wearing apparel and the requirements of the ship. The last three vessels built on the Clyde for the Orient Royal Mail Company, Ltd., viz.: the *Orsova,* the *Osterley* and the *Otway,* were each fitted with a modern steam laundry by Messrs. D. & J. Tullis, Ltd., of Clydebank. The laundry plant of each of these vessels consists of two all-metal power-driven washing machines, with a stationary outside casing of galvanized steel plate and an inner revolving shell of sheet brass, inside which the goods are washed. This washing cylinder is perforated with holes in a very ingenious manner, the punching being done from the inside of the sheet, and the holes countersunk and round off so that the washing surface on the inside of the shell, with which the goods actually come into contact, is absolutely smooth and free from any rough projection likely to damage the linen.

From the washing machine the goods are conveyed to a hydro-extractor, the purpose of which is to remove all loose water from the articles as they are taken from the washing machine before they are hung up to dry. This machine also consists of an outer or stationary casing of steel boiler plate, and an internal perforated steel basket, which revolves at 1,400 revolutions per minute. The action of the machine when running packed with goods is to extract the loose water and throw it out at the perforations, after which it is drained off from the machine. The extracting process only occupies about 15 to 20 minutes, in which period articles to the aggregate of 40 pounds weight when dry can be treated.

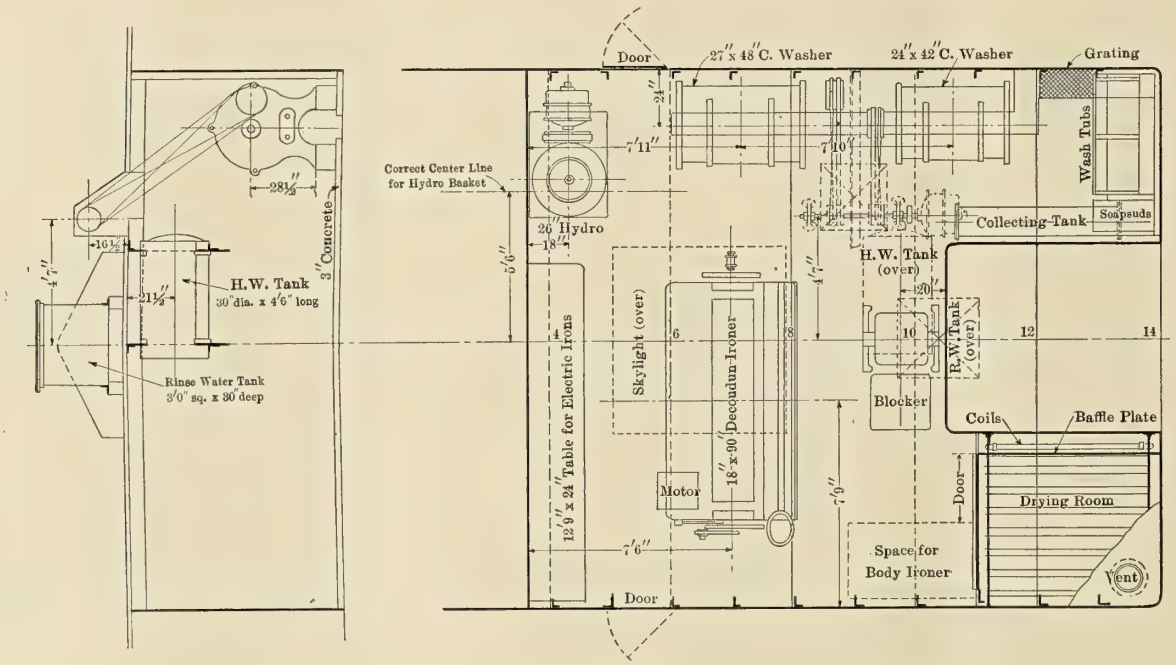
The next process is hanging up to dry, which is accomplished in a small chamber measuring about 8 feet by 6 feet, fitted with tubular hanging rails and heated to a high temperature with steam pipes. After drying, the goods are ready for finishing in the calender, which is of the single roller or Decoudun type. This machine, which is of heavy and powerful design, consists of a steam-heated polished bed of cast iron, in which a padded cast iron roller revolves, also steam heated. The process consists in passing the goods over the steam-heated bed, where they come into contact with the revolving roller, and are finished in the desired manner. This type of machine is specially adapted for finishing table linen, or any article where it is desirable to impart a shine or polish. An ingenious device is attached to the machine in the shape of an automatic



DECOUDUN IRONING MACHINE.

finger guard, which stops the machine instantaneously should the worker's fingers come into contact with the revolving roller. All danger of accident is thus obviated.

An important section of the installation is the soapy-water saving apparatus, the object of which is to collect and re-use the rinse water which is not actually dirty. The installation consists of a steel collecting tank, into which is led all rinse water from the washing machines, hydro-extractor and wash tubs. From this collecting tank it is forced up into an overhead storage tank by means of a powerful ejector, and from that point it is redistributed to the machines requiring same. The economy of an apparatus of this description is considerable, and most important in view of the scarcity of fresh water at sea.



ARRANGEMENT OF LAUNDRY ON THE NEW STEAMERS OF THE ORIENT ROYAL MAIL LINE.

In addition to what has already been described there is a set of teakwood hand-wash tubs, in which special articles, such as ladies' finery, can be washed by hand; a soap and soda dissolving tank for supplying the machines in the laundry; a yellow pine hand-ironing table with electric irons; a hot-water tank with steam coil for supplying hot water to the

machines in the laundry requiring same, and a complete equipment of shafting pulleys, belting and piping services.

The power in the laundry is provided by electric motors, three in number; one of 2 brake-horsepower, driving the two washing machines through a shaft, and a 2 brake-horsepower motor driving the hydro-extractor, and one of similar power being directly coupled to the Decoudun ironing machine. It will be seen therefore that all sections of the laundry can be driven independent of each other.

Each of the three ships above referred to has the same equipment of laundry machinery, although the "lay out" is slightly different in each case.

Rulings of the Office of the Supervising Inspector-General of the United States Steamboat Inspection Service.

Experimental tests having been conducted of oxy-acetylene welding done by the Vulcan Brazing & Machine Company, of Philadelphia, Pa., such work done by the above-named company may be permitted on vessels subject to the inspection of this service.

Under date of July 14, in a letter to the Supervising Inspector of the Third District, relative to section 1, Rule 1, General Rules and Regulations of the Board of Supervising Inspectors, edition of January, 1910, and also with reference to section 4430 and 4431, R. S. U. S., all having to do with the testing of plates used in the construction or repairs of steam boilers, the Local Inspectors at Norfolk, Va., holding that from the wording of the article and sections referred to it is possible to assume that *all* material entering into the construction or repairs of marine boilers must be tested in the presence of an assistant inspector, and stamped by him with the official stamp of the Government and his initial stamped thereon, this office stated, "that from a careful reading of sections 4430 and 4431, R. S. U. S., and of section 1, Rule 1, General Rules and Regulations, edition of January, 1910, and by comparison of section 1, Rule 1, General Rules and Regulations, edition of 1910, with the editions of previous years, and after a consideration of the sections that follow in Rule 1, General Rules and Regulations, this office is of the opinion that it was the intention of the Board of Supervising Inspectors to require, not that all material entering into the construction or repairs of marine boilers must be tested in the presence of an assistant inspector and stamped by him with the official stamp of the Government and his initials stamped thereon, but only material used in the construction or repairs of marine boilers subject to tensile strain, which must be tested in the presence of an inspector before it is stamped with the tensile strain that it will bear."

Numerous questions having been asked by inspectors and others concerned, relative to the Motor Boat Act effective July 9, 1910, the following excerpts of letters written by this office relative thereto are given for the information and guidance of all concerned:

Under date of July 6, in a letter to the Supervising Inspector of the Third District, answering certain questions propounded by the Local Inspectors at Charleston, S. C., this office stated that the Local Inspectors at Charleston, S. C., "may be informed that *no* vessels, whether propelled by motor or by steam and not more than 65 feet in length, except tug boats and tow boats propelled by steam, require licensed officers unless they carry passengers for hire, in which event they must be in charge of a licensed operator.

"A licensed operator is allowed to take charge of a vessel, whether propelled by motor or by steam, when she is carrying passengers for hire and is less than 65 feet in length, except tug boats and tow boats propelled by steam, which must have the usual licensed pilots and engineers.

"Motor boats over 15 gross tons engaged in the carriage of freight or passengers for hire must be inspected; if they are also over 65 feet in length they must carry a licensed engineer and a licensed pilot.

"*All* steam vessels must be inspected as heretofore, but if the steam vessel be used for pleasure purposes only, and is less than 65 feet in length, then a licensed operator or engineer is not required."

Under date of July 6, in a letter to the Supervising Inspector of the Third District, answering questions propounded by the Local Inspectors at Jacksonville, Fla., this office stated, "that the design of the engine, boiler or other operating machinery of motor boats more than 40 feet in length and not more than 65 feet in length propelled by machinery driven by steam is to be approved only at the first time, unless the design is later changed, in which event it must again be approved by the local inspectors.

"As this office holds that *all* steam vessels are still subject to *inspection,* it is necessary that such steam vessels carry all of the life-saving equipment heretofore required.

"A vessel over 40 feet in length and not more than 65 feet in length, propelled by machinery driven by steam, that does not tow for hire, is to be considered a towing boat within the meaning of the Act of June 9, 1910.

"A steam pleasure yacht more than 40 feet in length and not more than 65 feet in length, propelled by machinery driven by steam, requires no licensed officers, but if she carry passengers for hire she must be in charge of a licensed operator, but it is not required that she be in charge of a licensed engineer. Such a vessel would be required to carry all life-saving equipment heretofore required."

Under date of July 7, in a letter to the Supervising Inspector of the Second District, relative to the New Motor Boat Act, this office stated, "In reply to your question, 'Is the definition of a motor boat contained in this Act to be considered as repealing the provisions of section 4426 in so far as they relate to towing vessels of Class 3 motor boats', you are advised that the provisions of section 4426, R. S. U. S., in so far as they relate to towing vessels *propelled by steam,* are not repealed. If a *steamer* be over 15 gross tons engaged in the transportation of freight or passengers for hire and be *less* than 65 feet in length, it is necessary that she be inspected, and that she be in charge of a licensed operator, but it is not required that she have a licensed engineer. In other words, *every* steam vessel is subject to inspection as heretofore, but not every steam vessel is required to carry the usual licensed officers as heretofore.

"With reference to motor boats other than those propelled by steam, it may be stated that if the boat is over 15 gross tons engaged in the transportation of passengers or freight for hire, she must be inspected and she must be in charge of a licensed operator, but the usual licensed pilot and licensed engineer are not required unless she *also* be over 65 feet in length. If a motor boat propelled by other means than by steam under 65 feet in length be engaged in the transportation of passengers for hire, then it is required that she be in charge of a licensed operator. Motor boats propelled by other means than by steam engaged in towing are required to have neither inspection nor licensed officers."

A New Steamer for the Eastern and Australian Trade.

Messrs. Workman, Clark & Company, Ltd., Belfast, have recently designed and built a new steamer for the Eastern & Australian Steamship Company, Ltd., London. The new vessel has been named *St. Albans,* and is 381 feet in length, with a gross tonnage of about 4,500. She will trade between Australian and Chinese ports.

Accommodation for 63 first class passengers is provided in commodious staterooms arranged for one, two and three persons on the bridge and upper decks, and for 36 second class passengers in large, four-berth rooms at the after end of the bridge space. The first class public rooms include a spacious and well lighted dining saloon, a tastefully furnished drawing room and a comfortable smoke room. The second class passengers are provided with comfortably furnished dining saloon, lounge and smoke room. Accommodation for European steerage passengers has been arranged in the poop space, and for Chinese steerage on the main deck forward. As the vessel is intended for service in tropical climates, special attention has been given to the ventilation of the passenger accommodation throughout the vessel.

The cargo space is divided into four holds, and one of these has been insulated and prepared for the carriage of frozen meat, while the 'tween deck space over this hold has also been insulated and fitted up for meat and fruit cargoes and perishable stores. For the preservation of these cargoes and stores a plant of refrigerating machinery has been installed. Each of the holds is furnished with a large hatchway, suitably equipped with steam winches, derricks and other appliances necessary for expeditiously handling general cargo.

The propelling machinery consists of a set of triple expansion engines, having all the most modern improvements and auxiliaries and supplied with steam from four single-ended cylindrical multi-tubular boilers working under forced draft.

The vessel has been built under special survey for the highest class in Lloyd's Registry of Shipping, and fulfils the requirements of the British Board of Trade.

TWIN-SCREW FERRY STEAMERS FOR CALCUTTA.

Messrs. John I. Thornycroft & Company, Ltd., recently shipped from their Woolston Works at Southampton four twin-screw ferry steamers for the Port Commissioners of Calcutta for their passenger service. About three years ago Messrs. Thornycroft delivered seven ferry steamers to the

TYPE OF FERRY STEAMER FOR CALCUTTA SERVICE.

Port Commissioners for a new passenger service which they were inaugurating. These boats proved so successful that a further order for four boats was placed. These were erected at the Woolston Works, properly marked for re-erection, and shipped by the Peninsular & Oriental Company's line.

The following are the leading particulars of these boats:

Length over all	105 feet.
Length between perpendiculars	100 feet.
Breadth, molded	20 feet.
Depth, molded	10 feet.
Draft (loaded)	5 feet.
Speed	12 knots.
Indicated horsepower	500

The vessels are built of steel to Lloyd's A-1 (River Class) and Board of Trade requirements for special passenger certificate. Special attention has been given to the sub-division of the hull, there being no fewer than seven complete watertight bulkheads. There are two stout wood fender belts, one extending all round the vessel near the deck, and one from the forward to aft bulkheads near the waterline. A wood awning extends over the whole of the upper deck, and a navigating bridge, also with a wood awning, immediately in front of the funnel.

The machinery is placed amidships, and the arrangement of hull provides for four cabins for passengers, two forward and two aft, each with a roomy stairway and companion. Nominally the vessel is to carry 200 passengers, but there is room for a considerably larger number.

The machinery consists of two sets of tri-compound surface-condensing engines, and a marine type boiler of extra large size to deal with the rather poor quality native coal, working with natural draft, or when required with forced draft on the closed stokehold system. The cylinders are 9 inches, 13 inches and 20½ inches diameter, with a stroke of 11 inches, working at about 300 revolutions per minute. The boiler is 11 feet 6 inches diameter and 10 feet 3 inches long, with a heating surface of 1,267 square feet and a grate area of 42 square feet, with a working pressure of 180 pounds.

Steam Yacht Doris.

One of the most spacious steam yachts of recent years is the *Doris,* of 1,000 tons Thames measurement, built by Messrs. John Brown & Company, Clydebank, Glasgow, for Mr. S. B. Joel. This yacht is schooner-rigged with two pole masts, and is of the shade-deck type with a large promenade deck amidships and a built-up forecastle. The dimensions are 228 feet between perpendiculars, 270 feet length over all; breadth, 31 feet.

The accommodation is very large and compact, and includes on the promenade deck a chart room, large smoking room, owner's business room and deck shelter. On the main deck under the raised forecastle is accommodation for the quartermaster, boatswain and carpenter, also the crew's galley and crew's lavatories. Amidships there is a long range of deckhouses under the shade deck.

At the forward end is the dining room, capable of dining eighteen persons; vestibule, pantry and main galley. Aft of the engine casing and connected to the forward accommodation by a passageway is a large drawing room, with double doors opening to a deck shelter at the after end. The captain's room is situated between the engine and the boiler casings.

On the cabin deck, forward of the machinery space, are the principal rooms for the owner and his guests, consisting of five staterooms, bath rooms and dressing room. Immediately aft of the machinery space there are a children's nursery and dining room, five staterooms, bath rooms; then right aft are cabins, etc., for the servants. The officers and crew are berthed forward, with exceptional accommodation.

The propelling machinery consists of two sets of triple-expansion engines, each having four cranks, with cylinders 16 inches, 26 inches and (two) 30 inches diameter by 26 inches stroke, driving twin screws. There are two return tube boilers. The bunkers are ample for a large cruising radius, and there is a complete installation of electric light and refrigerating machinery. One of the special features of the yacht is that it is arranged to coal through ports in the topsides. This has never been done before in a yacht of this type.

Messrs. G. L. Watson & Company, Glasgow, designed and have superintended the construction of the *Doris.*

Danish Car Ferry Odin.

BY AXEL HOLM.

Burmeister & Wain, Copenhagen, Denmark, recently built for the Danish Government railroads a new car ferry which has been named the *Odin*. The hull is 293 feet 9 inches long over all, and 290 feet long on the waterline. The breadth over the guards is 58 feet 9 inches, and on the waterline 48 feet 6 inches. The molded depth is 18 feet 7 inches, and the full load draft, when the vessel is loaded with 300 tons of cars on the deck and 130 tons of coal in the bunkers, is 12 feet 5 inches.

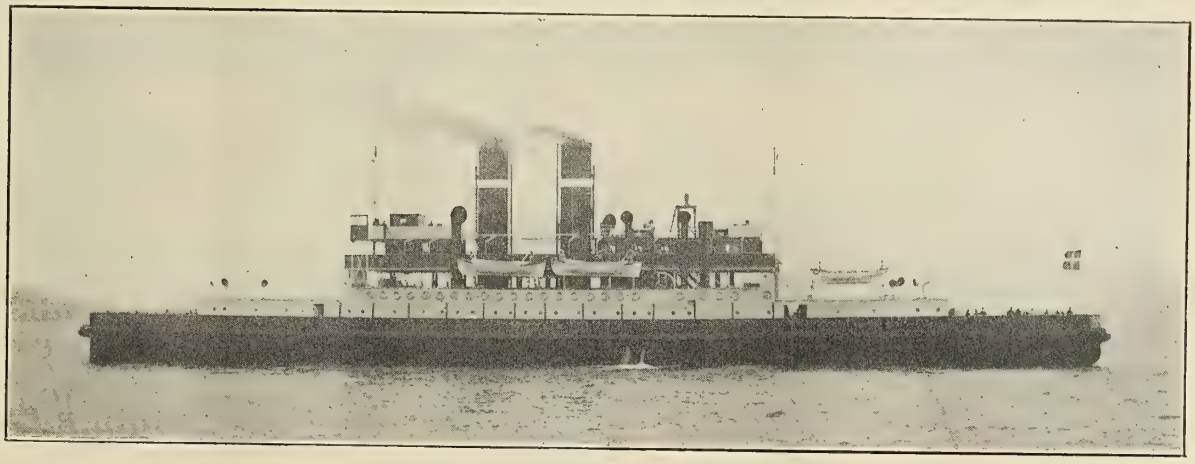
The ferry is a double tracker and has twin-screw engines, with a combined horsepower of 1,800, which, on her trial trip, drove the vessel at a speed of 15 knots. In all details the ferry is a sister ship of the *Christian IX*, built by the same firm during 1908, plans and descriptions of which appeared in the April, 1909, issue of International Marine Engineering.

The *Odin* is now plying in regular service between the ports of Korson and Nybork, Denmark.

sheathed with wood on the poop, bridge, forecastle and promenade decks, and the whole of the passenger accommodation and public rooms are bright and cheerful, being lighted by large sidelights and specially ventilated in view of the tropical climate in which the vessels will be engaged. The height of the ceilings, from deck to deck, is 8 feet. Under the second class accommodation aft, provision is made for large icehouses, mail rooms, specie rooms, paint rooms, lamp rooms and general store rooms; and spacious accommodation for the seamen, firemen and petty officers is arranged under the forecastle, with separate mess rooms and wash places for the crew and firemen.

The vessel is fitted with the usual complement of lifeboats, together with six surf boats of special design for carrying palm oil through the surf. A complete installation of electric light is fitted by Messrs. Campbell & Isherwood, including signal lamps, binnacle lamps, cargo clusters at each hatch, as well as oil lamps for emergency purposes. Steam-steering gear is placed amidships, and a quick-warping steam windlass forward, steam being supplied to all deck machinery from either of the main boilers.

The engines are of the triple-expansion type, by Messrs.



TWIN-SCREW, DOUBLE-TRACK DANISH CAR FERRY ODIN.

Steamship Akassa.

Messrs. Irvine's Shipbuilding & Dry Docks Company, Ltd., West Hartlepool, have recently built at their Middleton Shipyard the steel screw steamer *Akassa* for Messrs. Elder, Dempster & Company, Ltd., Liverpool. This is the eighth vessel built for this company, and is a sister ship to the *Tamele* and *Onitsha*. The dimensions of the *Akassa* are: Length, 375 feet; beam extreme, 50 feet; depth molded to upper deck, 25 feet 3 inches, having all the 'tween decks and houses 8 feet in height. She is classed 100 A1 at Lloyds, and has a cellular double bottom all fore and aft, with fore and after peak tanks for water ballast.

The vessel is divided into seven watertight compartments by six transverse bulkheads, and all appliances for the rapid loading and discharging of cargo have received every attention, there being nine powerful steam winches of the builder's own design, and ten derricks capable of lifting five tons each; provision is made on each mast for a special derrick dealing with 30-ton loads, while the whole of the mast arrangement is strengthened to lift 40 tons.

Accommodation for 30 first class passengers, in two-berth staterooms, is arranged under the bridge, with ladies' cabins, lavatories, baths, etc., and second class passenger accommodation at the after end under the poop. The dining room is on top of the bridge and the smoking room and accommodation for the captain and officers is on the promenade deck above, which extends the whole length of the bridge. The engineers and other officers are berthed in steel houses under the bridge deck at the after end. The vessel has steel decks

Richardsons, Westgarth & Company, Ltd., Hartlepool, having cylinders 25 inches, 40 inches, 68 inches by 48 inches stroke, with three main boilers working at a pressure of 180 pounds per square inch, and capable of driving the vessel at a fair rate of speed when loaded. A Contraflo condenser is fitted, by which it is claimed a vacuum of 27 inches can be carried in sea water up to 85 degrees.

The 1911 National Motor Boat Show will be held at Madison Square Garden, Feb. 21 to March 4, under the auspices of the National Association of Engine and Boat Manufacturers. The show will be open daily from 9 A. M. to 11 P. M., excepting Sunday.

The Bureau of Navigation reports 127 sail and steam vessels of 14,020 gross tons built in the United States and officially numbered during the month of August, 1910. Of these, six steel steamers of 2243 gross tons were built on the Atlantic and Gulf coasts and five steel steamers of 8,611 gross tons on the Great Lakes.

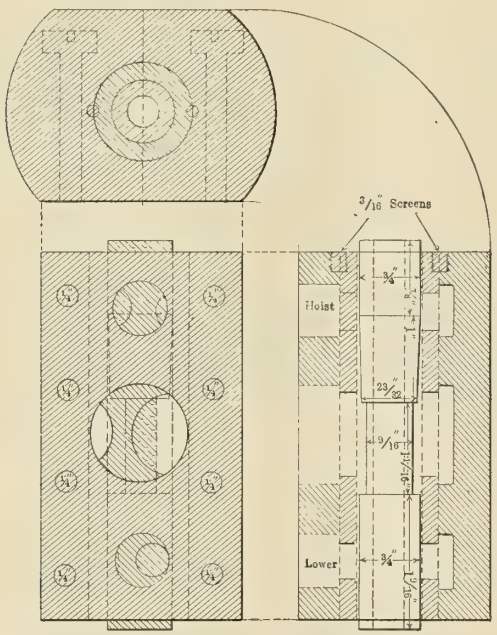
The Economy of oil fuel is shown by some comparative figures giving the cost of fuel used during one month on board seven steamers plying on the bay and rivers near San Francisco. Figures are given for the operation of these vessels using first coal then oil, and the average saving in cost of fuel per month gained by the use of oil fuel is 47 percent. This exceptional gain is due partly, of course, to the high price of coal on the Pacific Coast.

PRACTICAL EXPERIENCES OF MARINE ENGINEERS.

Incidents Relating to the Design, Care and Handling of Marine Engines, Boilers and Auxiliaries; Breakdowns at Sea and Repairs.

Modification of an Ash-Hoisting Engine.

Trouble was experienced on this vessel with the ash-hoisting engine, which is of the vertical tandem type with over-hung cranks, having cylinders 3½ inches in diameter with a stroke of 6 inches, the diameter of the hoisting drum being 8 inches. For its operation the engine depended upon a D-slide controlling valve, connected to a vertical valve stem and rod, fitted with tappets for the proper regulation of hoist. About 2 inches above the valve stem stuffing-box a crosshead with two wrist pins is secured by means of a set screw. The wrist pins, and hence the controlling valve, are moved by means of a forked guide lever, connected to a horizontal shaft, which in



DETAILS OF VALVE FOR ASH-HOISTING ENGINE.

turn is operated from deck by means of a vertical shaft and bevel gears. Moving the crank on deck slightly to the right or left from its neutral position would move the valve up or down, and so hoist or lower the bucket.

The reduced steam pressure behind the valve, however, was too great to admit of its proper operation, the operator having to use both hands to start the valve, thus putting considerable strain on the valve-operating gear. The steam ports were 25/8 inches wide, and the port opening could not be controlled on account of the great friction between the valve and seat. The result was that when the valve was jerked open the port opening would be such that the ash bucket would shoot up the ventilator like a shot out of a gun, and it might as well have been thrown down as to have been lowered by the engine.

Various alterations were suggested, but none were successful, so we took out the flat controlling valve and removed the false valve seat. Measurements were then taken, and a valve chest made from a round piece of cast iron 4 inches in diameter and 4¼ inches long. This was bored, recessed drilled and faced, and a small working liner with corresponding steam and exhaust ports fitted for the valve. The valve was made ¾ inch in diameter, but still proved to admit too much steam to the cylinders while lowering the bucket, so we finally got a valve the size and shape of which is shown in the sketch. The operation of the hoist is now easily controlled and has given no further trouble.

A. N. Metzelaar,
U. S. S. *Vicksburg*. Chief Machinist's Mate, U. S. N.

Fixture for Re-Forming Magneto Cable Ends.

A handy fixture is shown below, which the writer had occasion to use for re-forming the spark plug ends of magneto cables used on automobile engines.

Magnetos with cables were bought from one company, and after some time a change was made in the cables, and it was

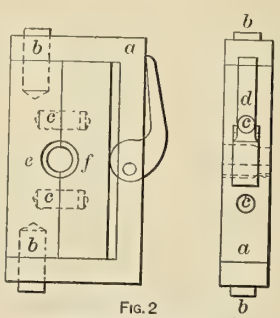


FIG. 2
DIE FOR REDUCING SPARK PLUG END OF MAGNETO CABLE.

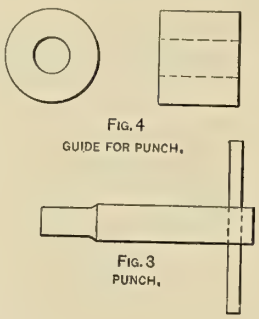


FIG. 4
GUIDE FOR PUNCH.

FIG. 3
PUNCH.

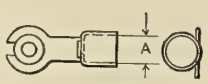


FIG. 1
MAGNETO CABLE SPARK PLUG END.

FIXTURES FOR RE-FORMING CABLE ENDS.

found that the new cables were 1/16 inch smaller in diameter, and, as a result, the terminal for the spark plug end of the cable was too large, and scraping this piece was out of the question, as this would involve considerable delay, which at the time could not be tolerated.

In Fig. 1 is shown the cable end; the diameter *A* being, as before stated, 1/16 inch large.

Fig. 2 shows the die for reducing the diameter *A*. This die was split in order to be able to place the work in it. The part *a* of the die pivoted on the pins *b*, which are fastened into the half of the die marked *c*; the other half was held by the eccentric which pivoted in *a*; the pin *c* locating this half of the die.

Fig. 3 shows the punch and Fig. 4 is a guide for the punch. This work was done by a boy in a small hand press and the piece trimmed on the end, this being caused by the redrawing of the metal.

C. T. Schaefer.

Precautions in Connection with Water Gages.

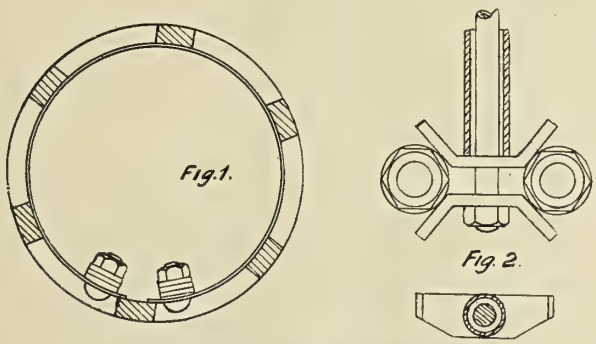
The water gage of a steam boiler, although undoubtedly a great safeguard when properly used, becomes an element of great danger when neglected, and cases are not wanting where grave explosions due to shortness of water have taken place, when the gage glasses appeared to show good water level. For this reason the gages should be frequently blown through in order to make sure that they are clear.

Very often after the gage glass has been drained and blown through the water rises very slowly. This is especially so in the case where the gages have pipe connections to the top and bottom of the boiler. If after having made sure that all the cocks are clear, the water still rises slowly, the water end pipes should be taken off at the first opportunity. In nine cases out of ten it will be found that the pipe is almost choked either with mud or with calcareous matter. In one case a set of these pipes was taken off owing to the sluggish action of the water in the gages, and it was found that although they were 1½ inches in internal diameter, the pipes were nearly solid with deposit. It was impossible to get even a piece of ¼-inch wire through the mud. It took a considerable amount of cleaning, probing and scraping to get them free, and there is no doubt that within a comparatively short space of time they would have been entirely blocked, in which case the gage would have been not only useless but deceptive, and given rise to a feeling of false security. Such cases show the importance of keeping water channels in a boiler completely free from incrustation and deposit.

Engine-Room Ventilators for Adjusting Engine Steam Distribution.

While the steamship ——— was on a voyage from the Gulf of Mexico to England, two or three loud knocks were heard from the intermediate-pressure cylinder, followed, before the engine could be stopped, by a loud crash and the sound of escaping steam. On investigation, after stopping, it was found that the intermediate cylinder was utterly wrecked.

The cover was lifted off as soon as possible. With its removal it became possible to guess fairly accurately what had happened. The head of one of the bolts holding the junk ring in place on the piston had broken off; the piston, on its upstroke, had punched this bolt head into the cover, which was a box casting, breaking a piece right out, this broken piece of cast iron had fallen on top of the piston, and, as it was of considerable size, on the next up-stroke the cover had been smashed. In addition, the piston rod was bent so that the cylinder in question was completely out of commission, and



APPLICATION OF VENTILATOR TO VALVE CHEST.

the only thing to do was dismantle the gear and work with the other cylinder. As the ship at that time was only three days' traveling from its destination it was not advisable to spend too much time over the repair.

The steam distribution to the damaged cylinder was by means of piston valves, but as the pistons were merely blocks of cast iron, with no packing rings, the obvious method of fastening them over the cylinder ports was not feasible, as the small holes for the valve spindle would not pass the steam readily enough. The question of cutting larger holes in the valve pistons was discussed, and dismissed as taking too long; and it was decided to make a rough wooden cover for the cylinder and attempt to adjust the expansion of the steam in the cylinders, so as to keep the pressure in the damaged cylinder as near that of the atmosphere as possible.

Just as the work was being commenced, someone discovered that one of the engine-room ventilators was just a little larger in diameter than the valve pistons in question, so it was decided to use two lengths of the ventilator to block the cylinder ports. This was accomplished in the following way:

Two lengths of the ventilator were cut off, each about 6 inches longer than one of the valve pistons, and the seam cut out. They were then cleared of paint with strong caustic soda. Two holes were drilled near the opening and ¾-inch bolts and washers fitted. These rings were then sprung into the valve chest liners over the ports, so that the openings in the rings each coincided with a rib in the port, somewhat as shown in Fig. 1. To keep these thin rings in place and press them outward a piece of iron pipe was cut to the length between the top pair of ¾-inch bolts and the bottom pair. Through this pipe a rod, screwed at each end and fitted with nuts, was placed. At each end between the pipe two curved iron washers were placed. The shape of these washers and the position they occupied relatively to the bolts in the thin iron rings is indicated in Fig. 2, which shows the lower part. The arrangement was tightened up and the steam chest cover replaced, and, as by this time the unnecessary gear of the damaged cylinder had been removed and the spindle stuffing-box blocked, the engine was started. The result was satisfactory. The steam which leaked through the extemporized packing, and floated up from the damaged cylinder, was deflected by a canvas screen into the warm upward air current at the forward end of the engine room, whence it was carried away without causing much inconvenience.

The repair occupied about five hours all told and sufficed to carry the ship to its destination.

Explosion of a Main Boiler.

While on a voyage from London to Melbourne, Australia (a voyage which, by the way, proved to be the vessel's last), one of the main boilers of the S. S. "O——" exploded. The ship was supplied with two main boilers of the multitubular type, each having three internal furnaces, 4 feet 6 inches diameter. The shell was cylindrical of a mean diameter of 15 feet 11 inches, and its length over all was twelve feet. All the material used in the construction of the boiler was steel, excepting the stays and tubes, which were iron. The steel was manufactured at Sheffield, and was inspected by Lloyd's and passed in their usual way. The fittings consisted of two spring safety valves, loaded to 80 pounds per square inch and fitted with screw easing gear, which could be worked from the engine room; two pressure gages, graduated for 130 pounds, which had been tested and found to indicate 7 pounds more than the correct pressure (I understand this variation is general throughout the range); stop valve; glass water gage; two feed checks, valves, blow-off and surface cock, and hydrokineter.

In December, 1887, a large patch was put on the center furnace; in June, 1888, a small patch was put on the center furnace, and in October, 1888, the boilers were cleaned and calked. In May, 1889, both the above patches were renewed on the furnace. In September of 1889, the combustion chamber of the center furnace had a patch put on the back plate at the bottom, and eight stays renewed. In December, 1889, the rivets in the patches on the furnace were renewed, and the bottom of the boiler calked. The above were the first and only repairs made on the boiler since it was new, in 1880.

The boiler gave way in the central furnace, at the root of the flange of the "Adamson" joint, that was fitted at about the middle of the length. A piece about ½ inch in diameter was blown out, and the plate was cracked for a length of one and a half inches, on each side of the hole. The explosion was due, we found afterwards, to the fact that the plate had become reduced in thickness by corrosion, until it was no longer able to sustain the ordinary working pressure.

As soon as the explosion took place, the fire in that particular furnace was extinguished, and it was with great difficulty that the remaining two fires were drawn. We then started to make repairs in the following manner: The hole caused by the explosion was reamed out and a ¾-inch bolt and patch put on temporarily. When the boiler was filled with water and before steam was raised, the holes in the plating forming the bottom of the combustion chamber of the center furnace gave out. These were likewise temporarily patched, and it was decided to reduce the steam pressure from 80 pounds to 60 pounds, and the safety being set accordingly the vessel completed her voyage with the latter pressure.

On the arrival of the vessel in port, a number of holes having been bored in the furnaces and combustion chambers, the corrosion of the boiler was found to extend over a limited area, the plates being reduced in thickness from 7/16 inch to 1/16 inch at the thinnest part. The plates towards the bottom in the center and port combustion chambers were reduced in thickness from 7/16 inch originally to 5/16 inch and 3/16 inch respectively. Those parts were not easy to get at on the water side, as there was no manhole in the back of the boiler through which an examination could be made. The drill had never before been resorted to, and the hammer test would not have been an altogether reliable one. In the opinion of those in charge, the corrosion that had taken place at the parts above mentioned was due to the continued buckling and oxidation to which the plates had been subjected, and this was considerably augmented, and the pitting encouraged by the position of the feed water inlets on the back of the boiler. There were no internal pipes to these connections, consequently any acids brought in by the main feed would be more active about the center combustion chamber and furnace, where the plates seem to have deteriorated most, and this supposition was borne out by the fact that the patch which was put on the chamber back in the latter part of the previous year has wasted from 7/16 inch in thickness to 3/16 inch.

The cold-water feed from the donkey engine was delivered in the vicinity of the corroded plates in the port chamber. The process usually adopted in raising steam was thus: The center furnace was generally fired six hours ahead of the others, in fact, steam was often on the boiler before the other fires were lighted. The straining, in consequence, must have been very severe.

This explosion occurred from the defective condition of one of the furnaces of the boiler. The plate at the part that gave way was nearly corroded through. The vessel was temporarily disabled by the giving out of the boiler, but fortunately no serious result followed. It seems also that the boiler gave out in the bottom of the combustion chamber after the furnaces had been repaired. The corrosion, it is said, was only local; at any rate, ship and boiler were found to be much out of date, and so both found their way to the scrap heap. F. J. S. N.

On a recent voyage the *Mauretania* clipped 10 minutes from the westward trans-Atlantic record.

Fixture for Machining a Square Hole in a Punch Press.

Couplings with square holes through them are quite common in automobile work, and considerable thought has been given to their manufacture. The writer will endeavor to describe a fixture that has been successfully used for machining square holes in a punch instead of broaching them, as most manufacturers do. These couplings will run absolutely true if placed on an arbor and tested in a lathe.

Fig. 1 shows a specimen of the work done, while Fig. 2 shows the punch for punching the hole. This punch should be made with a clearance of 1/64 inch from cutting edge to depth

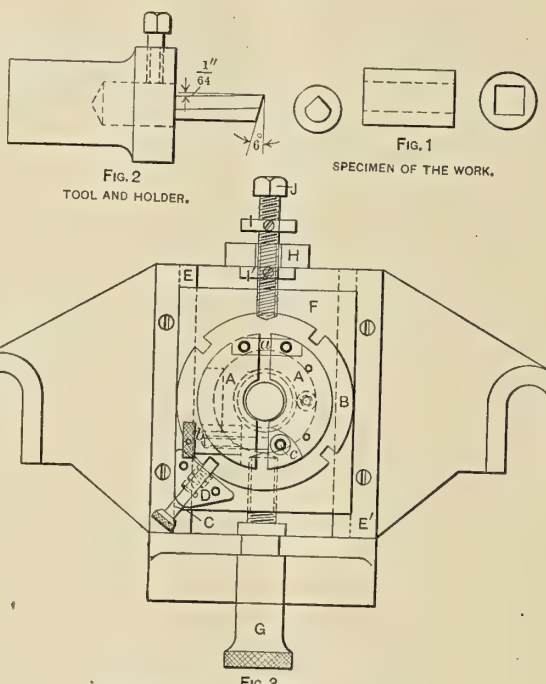


Fig. 2 TOOL AND HOLDER.

Fig. 1 SPECIMEN OF THE WORK.

Fig. 3 FIXTURE FOR HOLDING THE WORK.

METHOD OF MACHINING A SQUARE HOLE.

of cut, so that the chips will not heat up the punch, and the punch should have a shearing angle of 6 degrees, while the tool-holder shear is made to suit the press.

In the fixture shown in Fig. 3, *A* is a vise for holding the work, pivoting on hinge *a* and clamped by the nut *b*, which threads on a rod end, pivoting on pin *c*. The dividing device *B* is held in position by pin *C*, which is supported by a spring in the piece *D*, to hold pin in position in the dividing device. The vise and dividing device are fastened on a plate *F*, which is grooved on the sides and guide by the small plates *E E'*, and its movement back and forward is controlled by the screw *G*, while *H* is a stop for the travel of the fixture, and is controlled by the collars *I I'*, which are fastened to the set screws *J*, passing through a clearance hole in *H*.

The vise in the fixture could be made to carry split bushings, so that different classes and sizes of work could be done at a small expense, such as the ends of cam shafts or any piece which might require a square hole. C. T. Schaefer.

White Metal Safety Plugs.

In a good many ocean-going passenger vessels built in America, it is the custom to put safety plugs in the tops of the boiler combustion chambers, and one disadvantage which this practice has is that the white metal occasionally gets blown out of the plug even when the boilers

are not by any means short of water. This is probably due to deposit on the water side of the plug, allowing the heat of the boiler to operate on the plug while preventing the water in the boiler from keeping it sufficiently cool to prevent the white metal from liquifying.

A case in point may not be without interest. At the time of the occurrence the vessel had been at sea six or seven days, and when there was a three-fourths glass of water, and the ship was on even keel, the plug blew out. It was, of course, necessary to draw the boiler fires at once and to blow the boiler out and cool it down. When the engineers were able to get inside the boiler, which was two hours after the occurrence, and attempted to put a new plug in, it was found that the brass plug could not be moved at all, as it had become rusted into its seating. The boiler was, of course, so hot that no one could stay inside for very long, so that all that could be done at the time was to get a suitable tap and put a screw thread through the plug in the hole where the white metal had been and to screw a ¾-inch brass bolt into the hole thus formed, and this repair lasted until the vessel was brought into port, when the brass plug was drilled out and a new safety plug put in its place.

Defective Valve Gear.

While the steamship "D———" was on a trip from Dublin (Ireland) to Liverpool there was trouble caused by the low-pressure valve. The engines were brought up at sea through the cotter coming out of the slide valve cap, owing to the split pin through the cotter having broken off where it was opened, and, consequently, working out and allowing the cotter to work back.

The valve was then left loose on the spindle, and stopped on the cylinder face, owing to the pressure of steam on the back. We took the door off, replaced the cotter and split pin, and proceeded on our voyage. When we got to port we removed the split pin, and two pieces of steel plate were made duplicate with the end of the cotter. We then drilled a hole through the three and tapped them right through, having one plate each side of the cotter fastened with a ⅜-inch steel bolt.

F. J. S. N.

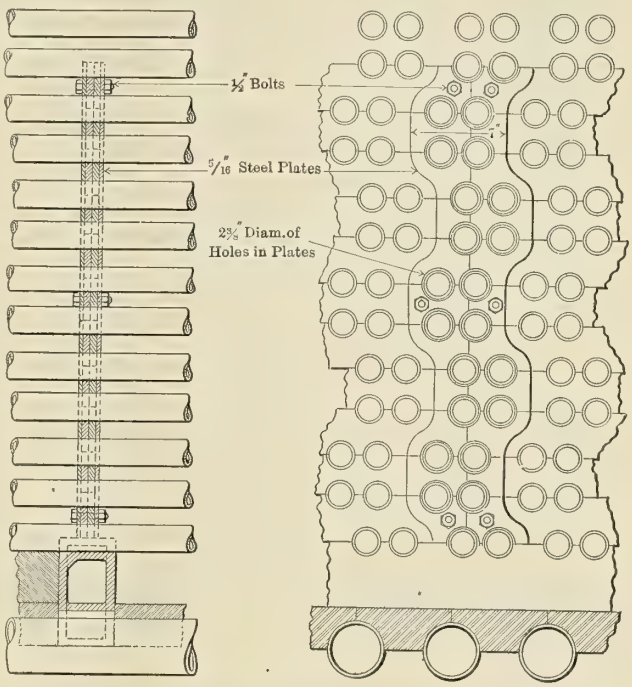
Flame Plates.

I have found in the course of my experience in repairing Babcock & Wilcox boilers, especially the larger type used on the armored cruisers of the United States navy, that the flame plates are not secured in the center of the boilers. This is a mistake, as these boilers have twenty-seven elements, and when a flame plate is 8 feet long, and is placed in position in the boiler and only secured at the outside end and the opposite end, a length of 8 feet from the securing point is allowed to go without being secured. The tubes being on an incline, the end which is in the center of the boiler sags and moves out of alinement, since there is nothing to hold it in position. This defect is hard to detect, occurring as it does in the center of the boiler, and it does not need to fall out of line a great deal to defeat the purpose for which it was placed there.

Because of this defect the products of combustion are allowed to pass directly to the smoke pipe instead of being consumed, and this causes the baffle plates, the boiler casings and the uptakes to become burned and distorted. The overheating of the casing at this point causes it to leak, and the cold air mixing with the hot gases interferes with combustion and increases the consumption of coal.

To remedy this defect I have taken four steel plates, 5/16 inch thick by 7 inches wide, and the required length, which in this case was long enough to take in twelve rows of 2-inch tubes.

These plates were a duplicate of the header face, except that the holes in the plates were enlarged to 2⅜ inches diameter. The holes were enlarged for the following reasons, viz.: to allow for the natural expansion of the tubes under heat; to allow the removal of a broken tube and to facilitate the removal of a broken flame plate. In order to insert these plates it was necessary to remove the 2-inch tubes from the three headers in the center of the boiler to allow a man to go in



METHOD OF SECURING FLAME PLATES AT CENTER OF BOILER.

and set the flame plates in line and to set the securing plates above described, on each side of the two rows of flame plates, in a vertical position, bolting them to each other at top, center and bottom, in this manner securing all the flame plates so that they will be held in a vertical position one above the other, making a perfect wall and baffle. The sketch shows the position of the flame plates and the securing plates in position.

Vallejo, Cal. C. J. Collins,
Chief Machinist, U. S. N.

A Broken Shaft.

The steamship "E———" was at sea, and everything was running well and smoothly, when, without warning the second length of tunnel shafting broke across the bearing, carrying the bearing completely away. The engines by this time were stopped, but, owing to the way on the ship, causing the propeller to revolve, the after end of the shafting twisted round on the top of the forward part, bending the broken ends badly. Immediately following this, the tail shaft, propeller, and broken tunnel shafting all slipped out against the rudder post. We then got screw jacks, patent blocks and tackles on to the shaft and worked it in, we then got the ends together as well as could be done, and fastened bands around the break as strong as the material at hand would allow. We then proceeded dead slow until assistance arrived, coming into port in tow of another steamer, and when we got there we took out the broken shaft and had a new one put in, and two lengths of tunnel shafting abaft the break sent ashore and trued up.

F. J. S. N.

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Saving Life at Sea.

Certain phases of the question of saving life at sea were considered in our last issue, and certain other phases of the same question are discussed by the same author this month. This discussion is confined to the question of the construction of the lifeboats which a vessel should carry and the means for lowering and disengaging them from the vessel while at sea. It is obvious, of course, that any apparatus designed to be used in an emergency or for the purpose of rescue either of a single person who has fallen overboard or of the entire ship's crew and passengers, when it is necessary to abandon the ship, should always be in perfect condition and ready for immediate use. Further, every device which will aid in the rapid execution of the few maneuvers which are necessary in the lowering of boats and safeguarding the lives of those on board should be given the minutest attention. No less important than the mechanism of the life saving apparatus itself is the personal factor or the degree of proficiency with which the crew is trained to perform its duties in an emergency. On merchant ships discipline is apt to appear to the eye of the casual observer somewhat lax. Much of the ceremonious naval etiquette practiced on a warship is entirely absent; but this does not mean that the authority of the officers over the crew is any less, nor that there is any laxity in the prompt obedience of the crew to their superiors. In general, as has been proved in the comparatively few serious disasters on board modern passenger steamships at sea, no fault could be found with the training of the crew. Invariably both officers and crew display great coolness and bravery in times of danger. With the certainty, therefore, that whatever apparatus is provided for saving life will be kept in good condition and properly manned, it is encouraging to see what developments have been made in life-saving apparatus which tend to increase the safety of ocean travel.

Marked improvements have been made during the last few years both in the design of the davits by which the boats are handled and in the design of the apparatus by which the boats are disengaged from the falls. It seems somewhat strange that so many years should have passed and so much improvement have been made in the construction of both the hull and machinery of steamships before any material improvement or modification was made in the davits for handling ships' boats. Although a most important part of the vessel's equipment, davits have until recently been constructed according to the same inconvenient and cumbersome designs which prevailed in the days of sailing ships. Since the light of scientific invention has been turned on this problem, however, new and common-sense methods have come into use whereby fewer men are needed to operate the davits and the davits themselves permit of swinging the boat away from the vessel's side a sufficient distance so that the ship can have considerable heel without the boat being dashed against its side when lowered. It is frequently suggested that the lifeboat should be lowered by power, using either small steam engines or electric motors for this purpose. Undoubtedly this would be an advantage if adequate hand gear was also provided which could be depended upon in case the source of power was damaged, as it very probably might be in event of collision or other mishap. Devices to be used in emergencies, however, should be made as simple as possible, and no complications which might cause confusion or delay at a critical moment should be tolerated.

Problems concerned with the safeguarding of life at sea include not only those dealing with the work of rescue, once an accident has occurred, but also the preventive measures which can be taken to minimize the possibility of ever having to depend upon the life-saving appliances which are installed. Modern developments in engineering have done much to solve this class of problems and the opportunities for serious accidents at sea are daily becoming less. Since the advent of the steel ship it has become possible to so sub-divide the hull with watertight bulkheads that, except in extreme cases, the vessel may be kept afloat at least until th

passengers and crew have escaped, even if the hull is seriously damaged below the waterline by collision or stranding. Theoretically, almost perfect safety to the vessel could be gained by a sufficiently minute sub-division of the hull into watertight compartments; but, practically, the cost of construction, the added weight to the hull and the breaking up of large cargo holds make it impossible to carry the watertight sub-division of a merchant vessel beyond certain limits if the vessel is to be a paying proposition. We believe, however, that present practice in this regard should be improved, particularly in the matter of sub-dividing the machinery space, so that a portion of the steam-generating apparatus, some of the pumps, and, if possible, part of the propelling machinery, can be kept intact after a collision causing admission of water to the machinery space. How much depends upon this was demonstrated by the sinking of the White Star steamship *Republic*. More information is also needed on the question of the strength of watertight bulkheads. Many bulkheads which to-day pass as watertight are not sufficiently strong or well braced to stand the test should they ever be subjected to full water pressure; and once a bulkhead begins to work, even if watertight in the beginning, leaks rapidly develop and its usefulness is destroyed. The adequate sub-division of a vessel by watertight bulkheads, and the proper design of such bulkheads, we believe to be highly important considerations among the precautionary measures which can be taken to save life at sea.

The Design of Columns for Ship Work.

We are beginning in this issue publication of an article which discusses very thoroughly the design of columns for ship work. Like almost every other part of a ship's structure, the columns and struts must be designed to withstand certain secondary loads whose magnitude cannot be determined exactly. This fact alone complicates the design of a ship's structure vastly more than that of a bridge or building, where all conditions can be carefully considered and provision made for them. The information on which this article is based is that acquired by the Bureau of Construction and Repair for the purpose of arranging a set of tables showing the safe unit loads of columns having a wide range of length ratios and constructed of various materials. In stating the requirements for ship work column tables emphasis is laid upon the fact that tables are preferable to formulas, because they are more convenient for office use, and since the formulas from which the tables are derived need not be simple in form, they can be made to agree more exactly with existing conditions. The tables, of course, should have a wide range of applicability, since the length ratios of columns for ship work must cover a wide range, the majority of them being wholly outside the range of usual structural engineering practice. Furthermore, they should be applicable to a wide range of materials, including various grades of iron and steel, brasses, bronzes and various kinds of wood. Tables which meet these requirements necessarily involve a great deal of labor for compilation and necessitate a careful review of all existing experiments, formulæ and investigations regarding the strength of materials under compression. The value of the tables will, of course, depend upon the thoroughness with which this work is carried out and the judgment used in the selection of the methods of calculation, as well as upon the extent and reliability of the data available. Recent investigations as to the strength of columns have done a good deal to upset existing theories and prove the inadequacy of existing formulæ when applied to problems of structural engineering. When this work is carried beyond the usual range of length ratios which are used in structural engineering, and an attempt is made to take account of the various complications which enter into ship work, it is evident that the lack of sufficient and comprehensive data will hamper the work. However, the problem has been attacked with a full knowledge of its limitations, and the results, we believe, will prove of great value to ship designers.

Precautions in Handling Oil Fuel.

Certain precautions must be observed in handling oil fuel on board ship if accidents such as that which occurred recently on the *North Dakota* are to be prevented. Apparently the accident on the *North Dakota* was due to leaky valves or leaky joints in the piping at a point where the temperature was high enough to ignite combustible gases. In view of this, it should be ascertained before taking oil on board that all valves and joints in the oil piping system are absolutely tight and efficient. Frequent observations should be made to insure that oil is not accumulating in the filling funnel. This is an indication of leaky valves, and the valves should be made tight at the first opportunity. All oil fuel tanks should be properly ventilated, an escape being provided for volatile gases at a safe point well above the deck of the ship. No oil should be allowed to accumulate in the bilges or on the stokehold floor plates, and a careful watch should be kept of the bilges to ascertain whether they contain any oil. Lighted material should positively be kept away from the bilges, and if any oil is discovered in the bilges the oil supply to the boilers should be shut off immediately, and, if coal fires are alight, they should be extinguished by water. If the oil in the bilge shows any signs of being overheated, water should be directed into the bilge to cool the oil and the ship's pumps used if necessary to clear the bilge. With reasonable care, there should be no danger of a fire due to oil fuel in the stokehold. Should a fire occur however, prompt and effective measures should be taken to overcome the blaze.

Progress of Naval Vessels.

The Bureau of Construction and Repair, Navy Department, reports the following percentages of completion of vessels for the United States navy:

BATTLESHIPS.

	Tons.	Knots.		Aug. 1.	Sept. 1.
Florida	20,000	20¾	Navy Yard, New York.....	71.0	74.2
Utah	20,000	20¾	New York Shipbuilding Co...	83.2	85.5
Arkansas ...	26,000	20½	New York Shipbuilding Co...	39.5	43.9
Wyoming ..	26,000	20½	Wm. Cramp & Sons.....	32.3	35.5

TORPEDO-BOAT DESTROYERS.

Paulding ...	742	29½	Bath Iron Works.....	93.4	98.9
Drayton	742	29½	Bath Iron Works.....	88.1	91.7
Roe	742	29½	Newp't News Shipbuilding Co.	97.1	99.3
Terry	742	29½	Newp't News Shipbuilding Co.	91.5	93.5
Perkins	742	29½	Fore River Shipbuilding Co...	92.3	93.8
Sterrett	742	29½	Fore River Shipbuilding Co...	88.4	89.8
McCall	742	29½	New York Shipbuilding Co...	89.6	95.5
Burrows	742	29½	New York Shipbuilding Co...	87.5	92.7
Warrington..	742	29½	Wm. Cramp & Sons.....	79.5	81.4
Mayrant	742	29½	Wm. Cramp & Sons.....	80.8	82.0
Monaghan ..	742	29½	Newp't News Shipbuilding Co.	28.4	31.3
Trippe	742	29½	Bath Iron Works.....	56.7	62.6
Walke	742	29½	Fore River Shipbuilding Co...	47.6	52.8
Ammen	742	29½	New York Shipbuilding Co...	56.3	65.4
Patterson ...	742	29½	Wm. Cramp & Sons.....	40.7	44.6

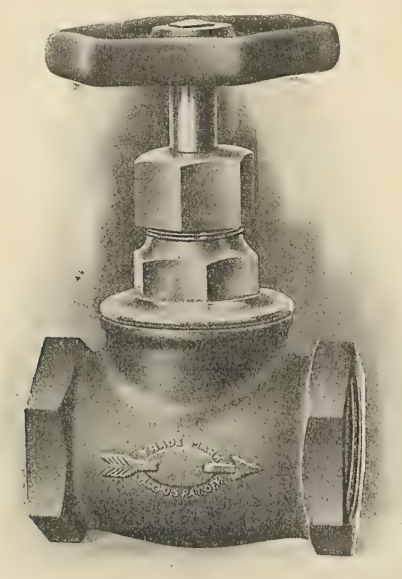
SUBMARINE TORPEDO BOATS.

Salmon	...	..	Fore River Shipbuilding Co...	97.8	98.4
Seal	...	..	Newp't News Shipbuilding Co.	52.2	54.4
Carp	...	..	Union Iron Works.....	60.0	62.0
Barracuda ..	...	..	Union Iron Works.....	60.0	62.7
Pickerel	...	..	The Moran Co.....	56.8	58.1
Skate	...	..	The Moran Co.....	56.8	58.1
Skipjack	...	..	Fore River Shipbuilding Co...	48.6	54.0
Sturgeon ...	...	..	Fore River Shipbuilding Co...	46.2	52.5
Tuna	...	..	Newp't News Shipbuilding Co.	29.9	31.8
Thrasher ...	...	..	Wm. Cramp & Sons.....	7.9	10.8

ENGINEERING SPECIALTIES.

A New High-Grade Valve.

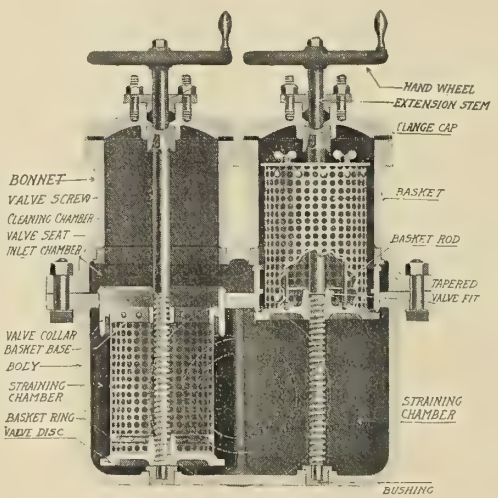
Arrow bronze globe, angle and cross valves are a recent product placed on the market by the Star Brass Manufacturing Company, Boston, Mass., and this new valve is of standard weight, mechanically designed so as to be correct and of



full pipe size area. It is expressly designed to fulfil the existing want for a low-price standard weight valve, and is not made for competition with the so-called "competition" type of valves. These valves are carefully made of the best steam metal, all parts being interchangeable. It is made in three styles, globe, angle and cross, with screw ends. Each valve is tested to 300 pounds per square inch hydrostatic pressure before shipment.

Multiple Strainers.

Nearly all sources of water supply, especially for circulating water, contain an immense amount of suspended matter, and while attempts are often made to remove this by placing a strainer around the suction pipe foot valve, this only transfers the source of trouble. The strainer soon becomes clogged and it is necessary to shut off the pumps while it is being cleaned. If the water is being used for condensers this means the loss of the vacuum and throwing an extra load upon the power equipment of the plant, and if there is no reserve power it means shutting down the plant. In order to get



around these difficulties, the Lagonda Manufacturing Company of Springfield, Ohio, has recently perfected a multiple strainer for removing impurities in feed water, circulating water, etc. These strainers can be installed in any position, horizontal, vertical or inclined. They also have the advantage that they are made up of different sections, which can be cleaned, one at a time, without interrupting the flow of water.

The strainer consists of a cast iron body having a number of removable strainer baskets, the number depending upon the size of the line. As these baskets can be easily removed for cleaning without shutting down the pumps, the mesh is made very fine; they thus eliminate more foreign matter than any other type of strainer. The water enters through the inlet pipe, passes up to the top of the valve chamber, where it divides, going down through all of the baskets in multiple. When it is desired to clean the strainer, one of the baskets is drawn to the upper part of the chamber by turning the hand-wheel; at the same time the valve collar is forced tightly against the valve seat and the valve disc on the bottom of the basket seats on the valve collar. This is all done automatically and entirely shuts off the water supply from the section containing the basket to be cleaned. By means of a small bypass the pressure in this chamber is now relieved and the bolts at the top loosened and the flange cap tilted over, exposing the basket. The basket can now be taken out and cleaned. In replacing the basket the operations are exactly the reverse. The next basket can now be removed in the same way and the whole strainer cleaned without shutting off the water. Should an obstruction rest upon the top valve collar, the basket, when raised to cleaning position, will have a tendency to tilt the obstruction either into the basket or out of the way of the valve. This is due to the fact that the basket travels nearly its entire distance before the lower valve disc comes into contact with the lower seat of the valve collar.

The effective straining area of a Lagonda Strainer is from 2¼ to 4 times the area of the pipe line, and in removing one

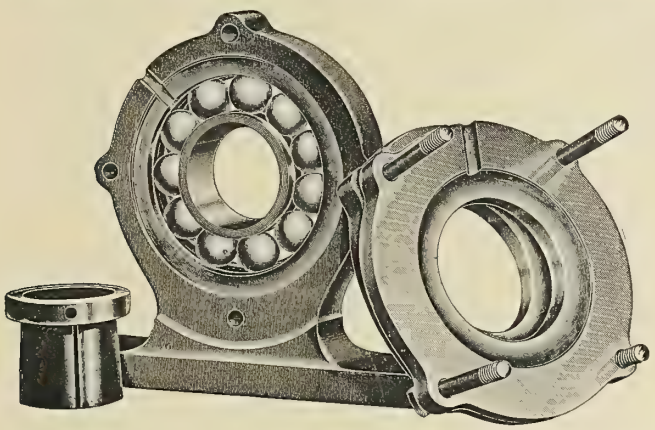
basket for cleaning the straining area is not reduced more than 30 percent; thus the pipe line is never throttled in the process of cleaning. In practice one of the baskets is left out of service, so that in case the baskets in use should become clogged the clean basket can be quickly lowered into service.

One important item concerning these strainers is that all of the internal parts subject to the action of water are made of bronze to eliminate troubles from corrosion. No leather or rubber washers are used.

Lagonda multiple strainers are built in sizes from 2 inches to 48 inches, having two to six baskets, the number depending upon the size of the strainer. They are also suitable for use in either suction or pressure lines, and are built to stand working pressures up to 200 pounds per square inch.

A Ball-Bearing Pillow Block.

The Bantam Anti-Friction Company, Bantam, Conn., have on the market a type of ball-bearing pillow block which is designed for excessive or high speeds. The illustration shows the partial disarrangement of the block, with the plates removed, bringing to view the ball races, method of oiling and

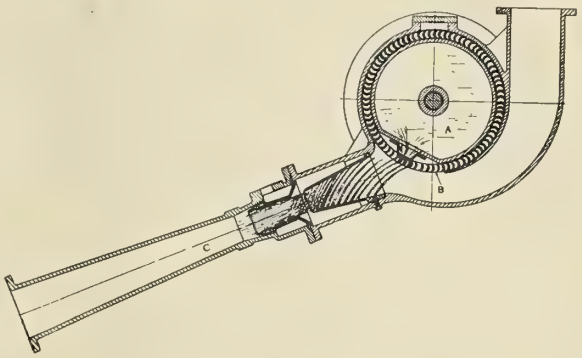


the clamping arrangement of the inner spool to the shaft. The races are made not of so-called tool steels, but of high-grade close-fiber machinery steels, carefully and well converted. The use of this grade of steel is a point for which the manufacturers have stubbornly fought for the last 12 years as being correct, and it is now interesting to learn that German manufacturers and engineers are accepting the same views.

The Westinghouse-Le Blanc Condenser.

The importance of obtaining a high vacuum with turbine engines has caused unusual attention to be given during the last few years to condensing apparatus. One development in this direction is illustrated herewith. It is known as the "Le Blanc" air pump and can be applied to an ordinary surface condensing plant, or in connection with a special type of jet condenser.

The principle on which this pump works is the use of a jet of water to remove the air from the condensers and compress and eject it against atmospheric pressure. The pump uses water moving at high velocity. The water is mechanically divided into successive layers, which entrain large volumes of air between them. These layers of water can be duly regarded as successive water pistons, each driving before it a charge of air. Referring to the section of the air pump illustrated: assuming that a vacuum has been established in the condenser, the water will flow from the chamber *A*, which is connected to the source of injection, into the turbine wheel *B*, which is running in a vacuum. This wheel literally pairs off thin layers of water, which are projected downwards through the diffuser *C*, and the interstices between these layers are filled with air. The pump impeller is driven by either an electric motor or a steam turbine on the same shaft, and usually there is connected to the other end of the shaft a centrifugal circulating pump. The impeller of the air pump is

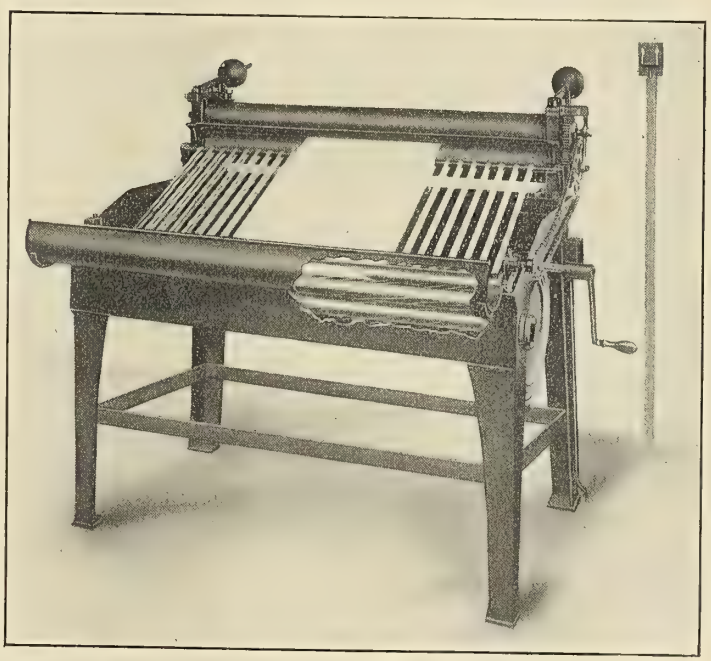


connected to the shaft and its rim is composed of a bronze ring furnished with blades. These blades are of cast bronze and are cast into the flanges which hold them, so that the completed ring is one piece of bronze.

The Mechanigraph.

The Mechanigraph is a machine which has just been placed on the market by Topping Brothers, 122 Chambers street, New York, which makes transparent and printable an opaque pencil or pen drawing at slight cost, thus enabling blue prints to be made from original drawings without the necessity of making tracings.

The machine consists merely of a series of electrically-warmed rolls; a chemical bath, also electrically warmed from the wire that warms the rolls; a series of traveling tapes, and



a pair of drier rolls. The whole machine, when set up ready to work, occupies a floor space less than 4 feet square. The operation consists merely in turning on the electric current, warming the rolls and bath, inserting the drawing, turning the crank and thereby running the drawing through the rolls, which press the chemical fluid into the drawing as it passes through. On leaving the rolls the drawing is conveyed by the traveling tapes to a pair of drier rolls, where the surplus

chemical is absorbed by surfacing paper inserted between the rolls. The drawing, therefore, comes from the machine practically dry, ready to be used for blue printing.

It is claimed that the mechanigraph makes any piece of white paper, no matter how heavy or opaque, transparent enough to blue print through quickly. The drawing may be made either in ink or pencil, as most convenient. It is claimed that there is no distortion or possibility of slip anywhere in the machine, so that the drawings are exactly the same as before being subject to treatment.

A further use of the machine is found in treating old and damaged tracings, which, it is claimed, may be made as good as new by passing through the machine.

TECHNICAL PUBLICATIONS.

Steamships and Their Story. By R. A. Fletcher. Size, 10 by 7 inches. Pages, 422; illustrations, 150. London, 1910: Sedgwick & Jackson. Price, 16/– net.

The above is a companion volume to "Sailing Ships and Their Story," which was reviewed in our issue for July. Mr. Fletcher has done his work well and the volume is a reliable reference book, dealing with a century's progress in the marine world. The volume is beautifully printed and replete with fine illustrations, which add considerably to the value of the book. It does the greatest credit to the publishers.

In a preliminary chapter, which covers 18 pages, the author deals with primitive experiments in propulsion. The next chapter covers the subject of the pioneers in steam navigation, where Fulton's work is fairly extensively dealt with. In another section Mr. Fletcher has given a short account of the foundation and early vessels of the various important steamship companies of this country. Then follows a section on railway companies and their vessels, and the opening of the transatlantic service. A chapter which is of special interest is one dealing with the development of steam auxilaries. Two chapters are devoted to experiments with iron shipbuilding and its development. The first of these has an excellent account of the *Great Britain*, and the latter some notes on the *Great Eastern*. The remaining three chapters are given up to discussions upon the more modern craft, and deals in addition to turbines with steam power and the navy, and the concluding chapter is upon miscellaneous vessels, in which the author discusses tugs, cargo boats, floating docks and eccentricities of design.

Mr. Fletcher has spared no pains in his research, and the result is a standard history of the steamship, which is extremely welcome.

Self-Taught Mechanical Drawing and Elementary Machine Design. By F. L. Sylvester, M. E., with additions by Erik Oberg. Size, 5 by 7½ inches. Pages, 333. Illustrations, 218. New York, 1910: Norman W. Henley Publishing Company. Price, $2.

A common fault with many text-books is that they are too advanced or theoretical to be of use to a practical mechanic, and when it comes to the selection of a suitable book for the man who has little or no knowledge of theoretical principles it is a difficult matter to find one which will answer his purposes. It is this lack of a suitable elementary book in mechanical drawing that has led to the publication of the work under review. The author has kept his aim well in view throughout the entire work, and it is primarily and essentially an elementary treatise and, as such, can be heartily recommended to practical men who wish to gain some knowledge of mechanical drawing and the common calculations necessary for machine design.

Reed's Drawings of Marine Turbine Engines. By W. T. Thorn. Size, 24 by 79 inches. Plates, two. Sunderland, 1910: Thomas Reed & Company, Ltd. Price, 3/6 net.

Since the steam turbine has come into general use for the propulsion of ships, every marine engineer should become familiar not only with the principles of operation, but with the design and construction and names of the various parts of these engines. These two sheets of drawings, which are of large size, show plainly the various details of a marine steam turbine, and an accompanying index gives the names of the various parts, so that they afford an excellent means of instruction in the details of a steam turbine.

Blue Book of American Shipping, 1910. Size, 7 by 9¾ inches. Pages, 611. Illustrations, 6. Cleveland, 1910: Penton Publishing Company. Price, $5.

As this is the fifteenth annual edition of this publication, it is hardly necessary to explain its main features, which are in general the same as in the previous editions. It contains the usual lists of American steam and sail vessels on the Atlantic and Pacific coasts, and rivers, and on the Great Lakes, and a list of vessels on the inland waters of Canada. The lists include such information as gross and net tonnage, principal dimensions, date of construction, name and address of owner or manager. There are also tables giving a list of the members of every important marine association or society in the United States, lists of the principal ship and engine building companies, various government officials connected with shipping and, finally, considerable information regarding the nature and volume of the water-borne traffic of the Great Lakes. The quantity and diversity of the data contained in the book make it an extremely valuable and useful book of reference.

Motor Control. By Andrew Olsson. Size, 5½ by 7¾ inches. Pages, 23. Diagrams, 5. New York, 1910: D. Van Nostrand & Company. Price, 50 cents net.

This is a brief manual comprising the first of an electrical series intended for use as text-books by students of the United States navy electrical shchools. The author has had a long service in the teaching corps of these schools, and is, therefore, enabled to present the matter in a highly practical form. The book deals only with the system of motor control used in connection with turret-turning and gun elevating, and is confined to a discussion of the Ward-Leonard system.

Hydrographic Surveying. By Commander Stuart V. S. C. Messum. Size, 5¼ by 7½ inches. Pages, 504. Figures, 262. Plates, 22. London, 1910: Charles Griffin & Company, Ltd. Philadelphia, 1910: J. B. Lippincott Company. Price (American edition), $3.75 net.

While most coast-surveying work is done by a fully-equipped surveying ship, commissioned for that purpose, there is still opportunity for beginners, seamen and others interested in the subject to make surveys of little-known parts of harbors and coast line, and to enable such observers to do this work with a fair degree of accuracy it is necessary that they should have a comprehensive knowledge of the use and limitations of the various instruments used, together with a complete understanding of the methods employed in such work. The author attempts to fill the need for a practical handbook for this work, and give such information as will enable the beginner to report intelligently and correctly to the proper authorities the changes that are occurring in the harbors, rivers, etc., and also to instruct those who are sufficiently interested to carry out original work along these lines. The first part of the book deals in great detail with all the instruments used for this work. Numerous illustrations and diagrams aid materially in explaining the text. The remainder of the book is divided into two parts, one of

which deals with projections and scales of charts and plans; and the other, which comprises the greater part of the work, with practical instruction in nautical surveying.

Fighting Ships, 1910. By Fred T. Jane. Size, 12 by 7½ inches. Pages, 525. Illustrations, about 500. London, 1910: Sampson Low, Marston & Company, Ltd. Price, 21s. net.

As a valuable book of reference regarding naval matters, this publication is in a class by itself. No other book uses so many or such excellent illustrations of the various warships of the world, both large and small, nor gives such complete details regarding the design and performance of these vessels in such clear and readily accessible form. This is the thirteenth year of issue, and, while the previous issues have been amply illustrated, this year's volume is notable in the number of new photographs, new plans and new silhouettes given, showing changes which have recently been made in existing warships.

Accuracy, of course, is an essential feature of such a book, but where the informtaion must be gathered from sources so diverse, and where, in general, every attempt is made to keep secret the details of new construction, it is no wonder that slight inaccuracies and discrepancies should be found. Interesting particulars are given regarding the newest ships under construction, particularly those of the German, British and South American navies. While the accuracy of these details cannot be vouched for, many of them, until this book appeared, were unknown to the majority of naval men.

As usual, a few pages in the back of the volume are devoted to timely articles by well-known authorities on naval matters, chief of which is one by Commander, Hovgaard on the "Future Development of the Sea-going Battleship," in which the importance of the submarine in future naval warfare is emphasized and present battleship design is modified to provide protection against this method of attack.

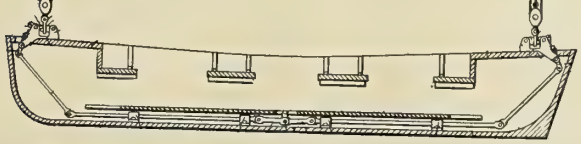
SELECTED MARINE PATENTS.

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents compiled by Delbert H. Decker, Esq., registered patent attorney, Loan & Trust Building, Washington, D. C.

955,163. RELEASING DEVICE. CHARLES HUNT, OF NEW YORK, N. Y.

Claim 1.—A releasing device for boats, comprising a frame for attachment to a boat; a holding bar journaled on the frame and adapted to hold a member of the launching tackle; a locking-block co-operating



with said holding bar; a releasing lever pivoted at one end to the locking block and its other end co-operating with said frame; and means for actuating said releasing lever to release the holding bar. Four claims.

957,820. BOAT. HARVEY WEBSTER VANIMAN, OF CINCINNATI, OHIO.

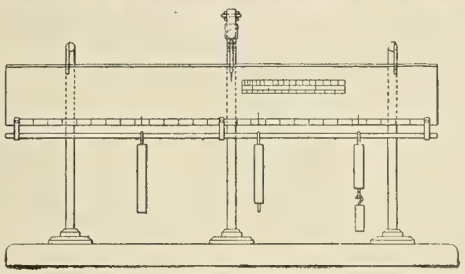
Claim 1.—A boat comprising a plurality of sections, each section being formed of sheet material bent to form a bottom and sides, and ends secured to the ends of the sides and bottom, angle plates connecting the ends to the sides and bottom, a reinforcing bar on the free edge of each side, a pair of angle plates on the under face of the bottom of each section and longitudinally of the boat, a bar arranged between the angle plates and connecting the sections, bolts traversing the bar and the angle plates, bolts connecting the ends of the adjacent sections, sundry of said sections having false bottoms, air chambers arranged between the said false bottom and the true bottom, said sections decreasing in size from the central to the end sections whereby to permit them to be arranged in nested relation, means for securing the sections together when so nested, and detachable handles connected with sundry of the sections. Three claims.

958,108. PROPELLER. GIUSEPPE GAYS, OF LOS ANGELES, CAL.

Claim.—An improved propeller having a plurality of spiral members or blades, the inner portion of each of which overlaps the inner portion of each of which overlaps the inner portion of each of the others; said spiral members or blades having varying thrust areas or operative superficial dimensions and being of the same pitch, each of said members extending approximately through 180 degrees of a circle; the outer edge portions of said spiral members or blades projecting radially and obliquely from the axis of the propeller; and said outer edge portions overlapping respectively the thrust areas of the adjacent members or blades. One claim.

958,192. DEVICE FOR DETERMINING THE METACENTRIC HEIGHT OF VESSELS. EDWIN TATE AND JEREMIAH MATTHEWS GOODALL, OF LONDON, ENGLAND.

Claim 1.—A device for determining the metacentric height of a vessel in any condition of loading, comprising a laterally movable beam, the length of which corresponds to the depth of the vessel and the weight of which represents the weight of the vessel in light condition, said beam being marked to scale with the positions of the centers of the cubic capacities of the holds for stowage of cargo, etc., and the



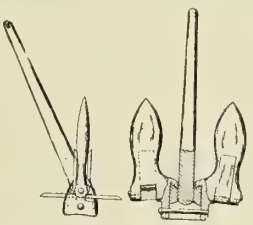
position of the transverse metacenter with the deadweights corresponding thereto, detachable weight movably suspended from said beam, and weights representing the deadweight carried by the vessel, side davits serving normally to support th beam, an intermediate davit and a lever carried by said intermediate davit on which said beam is adapted to be balanced. Three claims.

960,479. LIFE BOAT. JOHN E. ALLEN, OF VANCOUVER, BRITISH COLUMBIA, CANADA.

Claim 1.—In a marine vessel, the combination with the hull proper, of wing members disposed longitudinally and exteriorly of said hull, and downwardly and outwardly inclined partitions within said wing members to respectively divide the same into a plurality of compartments, each of said compartments having the outer wall thereof concavo-convex in contour. Two claims.

961,095. ANCHOR. WILLIAM M. BATEMAN, OF PHILADELPHIA, AND JAY C. LEVETT, OF CHESTER, PA.

Claim 2.—An anchor comprising a crown piece, flukes on the crown piece, a shank pivotally secured in the crown piece, said flukes having



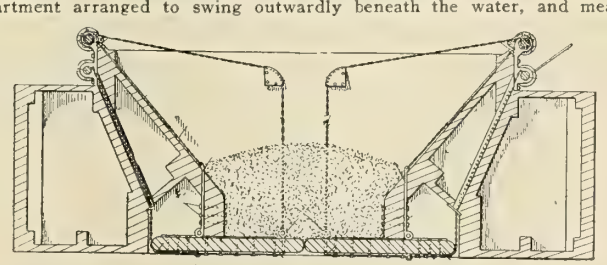
recesses in their ends, pins across said recesses, and angle floats pivotally supported on said pins. Four claims.

961,750. HIGH-SPEED BOAT. JOHN H. BRANTH, OF NEW YORK, N. Y.

Claim 3.—A boat comprising a hull the bottom of which is substantially horizontal in cross section and the bow of which is curved upwardly, the side portions of the hull being provided with longitudinally ranging downwardly directed keel-fins, and means for propelling the boat comprising a motor mounted therein, a propeller shaft connected therewith and passing downwardly and backwardly through the bottom of the hull of the boat and provided at its rear end with a propeller, the opening in the bottom of the hull through which the propeller shaft passes being inclosed by a hood which extends upwardly and forwardly to or approximately to the top of the hull. Six claims.

962,706. SCOW. CHARLES E. FOWLER, OF SEATTLE, WASH.

Claim 1.—A float having a cargo compartment, a door for said compartment arranged to swing outwardly beneath the water, and means



secured to said door and projecting on the opposite side of the point of swing thereof for applying force to move the door outwardly. Six claims.

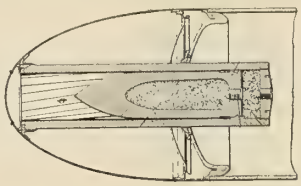
961,459. LIFE RAFT. WILLIAM S. RAY, OF SAN FRANCISCO, CAL., ASSIGNOR TO W. S. RAY MANUFACTURING COMPANY, OF SAN FRANCISCO, CAL., A CORPORATION OF CALIFORNIA.

Claim 1.—A life raft comprising parallel hollow cylinders each

formed with parallel horizontal flanges along its inner side, a diaphragm extending horizontally across each of the cylinders and dividing the same into upper and lower compartments, said diaphragm extending through the inner side of the cylinder between the horizontal flanges of the latter, and secured to said flanges, and connections between the cylinders. Ten claims.

964,147. TORPEDO. CLELAND DAVIS, OF THE UNITED STATES NAVY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO NATIONAL TORPEDO COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MAINE.

Claim 1.—In a torpedo, the combination with the shell thereof, of a gun barrel fixed to the same adapted to fire a projectile therefrom, and



means forming a fixed and rigid part of said shell adapted to exclude water from said barrel. Ten claims.

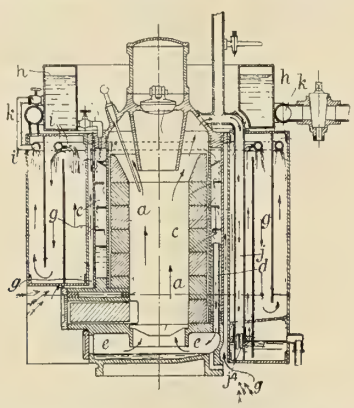
964,042. DREDGE-BUCKET. WILLIAM JOHN MOORE, OF VANCOUVER, BRITISH COLUMBIA, CANADA.

Claim 1.—A dredge comprising in combination, a water-tight bucket pivotally connected to the dipper arm of a dredge, a latch for securing the bucket against rotation on its pivots, means for holding said latch in a set position, and means governed by the movement of the bucket for releasing said holding means to permit said latch to latch the bucket against rotation on its pivots. Five claims.

British patents compiled by G. F. Redfern & Company, chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 21 Southampton building, W. C., London.

9,468. GAS PRODUCER PLANTS PREFERABLY FOR USE ON SHIPBOARD. A. W. WITHERS, LONDON.

In this apparatus the water supply tank and scrubber surround the furnace so as to form a unit, and there is a float for retaining the liquid seal during oscillation. Air passes up space *g* and enters vaporizer *c* at *x*. Here it is heated by radiation from the furnace *a* with water



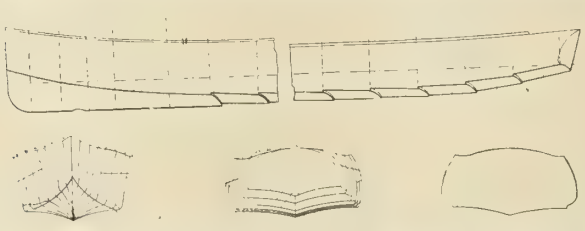
from tank *h*, and trickling over shelves then the air and vapor pass down pipes *d* through ashpit *e* and furnace *a*, where they become a gas, which leaves by pipe *j*, entering the scrubber at water-seal j^4. Here it is washed by jets from pipes *i* i^1, and issues for use from pipe k.

10,925. COMPASSES FOR PREVENTING ERRORS OF STEERING, AND INDICATING THE COURSE. L. NICHOLAS, WALTHAMSTOW.

The invention relates to a course indicator carried upon the compass card and moved to and set at any desired point. It is light, rigid, non-magnetic, accurately belanced and rests upon or about the nave of the card, only touching it there so that it revolves with it, but can be raised and turned about to any point. The object is to prevent erroneous alteration of the course, a very common cause of many disasters.

12,107. HYDROPLANE BOATS. W. H. FAUBER, NANTERRE, FRANCE.

Claim.—The operation of these boats is affected if they are exposed to waves. The bow becomes immerged and no force tends to reinstate it. This invention remedies this detrimental effect by constructing the



boat so that the surfaces of the bow form a greater longitudinal angle than that of the hydroplane members proper. Another feature is the arrangement of the hydroplane members beneath the stern, so as to permit the water to flow in behind the boat and counteract the pressure of water on the bow. Another feature is the form of the hull at the bilge line to give the advantages of the rounded bilge without its disadvantage when applied to hydroplanes. The bilge and sides are rounded, the difference from ordinary boats being that an angle is formed, so that the water thrown sidewise from beneath flows clear of the side and air enters between the bilge and the water.

16,255. THE CONSTRUCTION OF COMBUSTION CHAMBERS OF MARINE AND OTHER BOILERS. THE NORTH EASTERN MARINE ENGINEERING COMPANY, LTD., AND S. HUNTER, WALSEND.

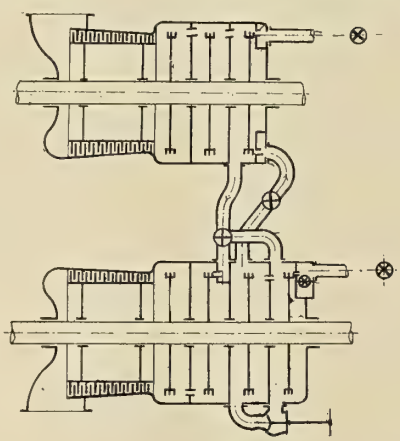
The improvements are in the wrapper plates of the chamber. The custom is to form the sides and top of the chamber of one plate of uniform thickness and the bottom of another plate of greater thickness. The inventors use only one wrapper plate. This is rolled with varying thicknesses. The thickest part forms the bottom of the chamber, and the thickness is gradually reduced to that of the sides. The single joint is arranged conveniently where it will be free from strains caused by expansion, contraction and bad circulation.

17,388. INDICATING A SHIP'S DEVIATIONS. W. H. HENNAH AND A. K. W. RISSEL, WELLINGTON, N. Z.

A stylus indicates upon a traveling strip the deviation of a ship from her course and sounds an alarm when the deviation continues for a set time or when a number of deviations aggregate, in time, this set period. The movement of the bowl round the card is used to close one or the other of two electric circuits that are both open when the card is in a central position. Each circuit, when closed, actuates a relay which completes a secondary magnetic circuit and so causes one of two clock mechanisms to move the stylus across the strip of paper to one side or the other of a line along it. The movement of the stylus a predetermined distance either way closes an alarm circuit and thus notifies a deviation.

23,312. TURBINE INSTALLATION WITH TWO SHAFTS FOR MARINE PROPULSION. AKT. GES. BROWN, BOVERI & CIE., BADEN, SWITZERLAND.

This is a two-shaft turbine installation for marine propulsion having partial impingment stages in which for normal power the turbines of each shaft work independently of those on the other shaft, while one or more additional stages are provided for smaller powers. These additional stages work in series connection with a portion of the stages for



normal powers, while the remaining stages are in parallel, and the cross-section areas for the nozzles are so chosen that they are, with series connection, sufficient for the total quantity of steam, and with parallel connection for half the quantity of steam. Thus the total number of additional stages necessary for decreased outputs or powers, as well as the number of manuvering of cruising devices to be actuated, are reduced.

25,781. DEVICES FOR PREVENTING OR LESSENING COLLISIONS. J. C. DE NEEF, ROTTERDAM, HOLLAND.

Claim.—The devices comprise side doors opening towards the stern and connected to the side by hinges and also by rods to a plunger enclosed in a cylinder within the ship, the rods pass through narrow openings in the hull of the vessel, so that in opening the doors, shock is avoided by the braking effect of the water which is being pressed by the plunger through the narrow openings. The cylinders are situated transversely of the ship, while the rods are entirely within the ship when the doors are closed. Latches engage hooks inside the doors and rods connect each set of latches and are lifted by chain gearing, after which the doors are opened partially by spiral springs. To lock the doors, drawing chains are wound up on the deck by a separate winch for each door, the latches being first lifted up by the hooks and then clasped in them.

29,661. LONG-DISTANCE SOUNDING MACHINE FOR SHIPS. A. CAPPELLINI. Commander in the Royal Italian Navy.

This invention is intended to provide a sea-lead for use in selecting a safe steerage in dangerous waters without decreasing the speed of the ship; 1 is a float having a recess for containing any suitable material for signals, such as calcium phosphide, and to this float a conical piece (3) with helical wings (4) is attached. At the point of the cone is a screw-threaded rod (5), and it turns in a nut (6), sliding in a guide forming a part of the bottom piece (2), which is so shaped as to not interfere with the operation of the screw (4) and to prevent rotation of piece 2. The apparatus is thrown from the ship in a case by a rocket or other means in the direction in which it is desired to effect soundings. On falling into the water the case opens, thus dropping the lead, which in its descent moves with a speed causing the screw to be rotated and unscrew the rod from the nut. Within the apparatus a graduated scale is provided for setting the apparatus for a depth necessary for the safety of the vessel. As soon as the rod 5 is unscrewed, piece 1 rises and indicates that there is the depth required. If the depth is less than that required and the apparatus touches bottom too soon, unscrewing of rod 5 stops prematurely, owing to interruption of the descent. The apparatus then remains assembled and submerged, and no signaling appears at the surface.